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Growth of Electrical Exports.

The steady, continuous growth in electrical exports is one of the most gratifying features of the American electrical manufacturing industry. This expansion has come in spite of such large development of American production abroad as that referred to by Mr. George Westinghouse in his recent annual report,—a condition that has certainly lessened in no small degree the export of many classes of apparatus. The figures for the year are now available in the detailed returns of the Department of Commerce and Labor, and they make an inspiriting exhibit. It appears that in the year ending June 30, 1906, the exports of electrical machinery reached a total of $7,869,137, as compared with $7,290,932 in the previous year; and that the exports of electrical instruments, including telegraphs and telephones, were $6,931,100, as compared with $4,962,972.

We thus have a total electrical export of not less than $14,800,237, as compared with $12,253,904, a gain of $2,546,333 in a single year. While some increase had been expected, as foretold by the individual monthly figures, this jump of two and a half millions is really surprising, being at the rate of 20 per cent. It will now be interesting to see whether such a rate can be maintained in 1906-7. There should be a healthy growth, anyhow, and it should be easy to surpass these figures, excellent as they are. We are making new customers and friends all over the world; consumption of apparatus was never larger, and electrical goods and appliances are everywhere in demand. Sometimes there is regret expressed that electricity does not enter into its own in this country more quickly, but when other regions of the globe are contemplated where the uses of electricity are still barely known, it is seen what a market is open in trying to bring those regions up to our own level of $12 a head per year for apparatus, current and service.

Defects in Certain Discount Sysems.

A system of discounts is in very common use among central stations of the United States which is open to considerable improvement. To be sure, all rate systems have their defects and are necessarily to a certain extent inequitable because it does not cost the central station company exactly the same to serve any two customers. The defects in the system we refer to, however, are questions of bookkeeping rather than of fundamental principle. The system is that in which, for example, a customer is given a certain rate for a consumption of less than 100 kw-hours; a discount of 10 per cent on the whole bill between 100 and 200 kw-hours; 20 per cent discount on the whole bill between 200 and 300 kw-hours and so on. With such a system there is always likely to be trouble of some kind when a customer's consumption approaches the even hundreds. A customer, for example, consuming 91 kw-hours gets a higher bill than one consuming 100 kw-hours, which inconsistency is sure to make trouble with a customer unless a remedy, of course, would be a modification of the system involving a gradation from one discount to another at each stepping point, but this would introduce bookkeeping complications. A far more logical and satisfactory plan is the system of which that in use at Grinnell, Iowa, described else-

where in this issue, is an example. Under this system a customer is charged a certain rate for the first 100 kw-hours consumed without regard to what he may consume over and above that. The second 100 kw-hours is charged at a lower rate and so on.

Southern Power Development.

Mr. Roman's note on this topic shows excellently well the difficulties that surround work at low heads in a country of cheap coal. Were it not for the concurrence of cheap material and labor, the southern situation, despite the amount of available water power, would be decidedly bad. The Appalachian region is one of enormous rainfall, the largest found in our country if one perhaps excepts a small portion of the Puget Sound region. The aggregate fall, too, from the sources of streams to the sea is large but unfortunately too gradual to produce powers cheap to develop or free from danger of back water. Only when one reaches the mountains themselves are really good heads obtained. Another singular peculiarity of the Appalachian region is the absence of lakes, so that from end to end of the main chain there is practically no natural storage whatever. One of the greatest chances for future work lies in the creation of artificial storage for the mountain streams, enabling the great yearly flow to be equalized. This has been done for many years on the Pacific Coast by the water companies working in a district far less favorable than the Appalachians as regards rainfall. The place to produce cheap electricity is in the regions of steep gradients, not where one has to utilize insignificant riffles in a wide and unreliable stream.

Despite these disadvantages of low head, some wonderfully cheap developments have been put through in the South, where the average price of electric energy is certainly much lower than anywhere else in the country. Great lack of wisdom was shown in the early Southern development in setting a price for energy far below a fair and reasonable figure considering the cost of fuel. The result has been a precedent very difficult to escape and fatal to profits unless circumstances are exceptionally favorable. Very low figures are quoted for the cost of energy from steam in the South, but we see no reason to suppose they are more accurate than similar figures from the North. It is notorious that even unusually capable and well informed managers often underestimate the cost of electricity by twenty to fifty per cent, owing to ignorance of the real average load, which is estimated rather than measured. We have seen such blunders made even in large electrical plants equipped with watt-hour meters, while in isolated plants of the ordinary kind the cost of energy per kilowatt hour is nearly always grossly underestimated. We do not believe that there is any real justification for the sale of electric energy to any kind of manufacturing plant for as little as $15 per horse power year when the energy is actually billed by meter or in any way actually measured. There are some very favorable powers in the South from which service can be profitably sold at an extremely low figure, but considering the nature of most of the developments, the ruling price of electric energy is far too low and investors would do well to bear this in mind. Until the mill owners get down to hard pan and acknowledge what energy really costs them, there is no such outlook for profitable electrical transmission as exists elsewhere in the country. Hence the lamentable way in which some meritorious Southern projects hang fire. It it is not due to the timidity of Northern capital, but to the fact that in the early stages of transmission work some very foolish prices were made, thereby establishing an unprofitable precedent.

Italian Water Power Development.

According to a recent statistical compliation made by a special commission, the total available water power in Italy would amount to 5,000,000 horse-power. In the 58 Italian provinces there are as available no fewer than 24,486 water falls, rivers and cataracts, which should give about 2,642,000 horse-power. Of this, 38.37 per cent is in Northern Italy, 28.06 per cent in Middle Italy, and 30.07 per cent in Southern Italy. Sicily contributes only about 5.45 per cent, and Sardinia only about .07 per cent. In this calculation, the power which can be obtained from the large rivers that would furnish about 767,000 horse-power, and of which only 175,000 has been utilized, has not been included. On the Tiber alone 500,000 horse-power could be developed, while at present only 100,000 is developed. The complete utilization of water power of which the country possesses such a splendid quantity, is a thing of great importance since Italy, poor in coal, imports annually several million tons of this article. In fact, the present industrial prosperity of the kingdom is testified to by the fact that the quantity of coal imported in the first three months of this year was 1,994,492 tons, or 654,000 tons more than in the corresponding period of 1905. This is an enormous increase. But after all the water powers must be a main source of supply of energy, and as Mr. Semenza pointed out last year in his lecture before the civil engineers of France, in Northern Italy the electrical transmission work is already on a very large scale of development. Several of the plants there, like that of Paderno, are of the first class, and have already been described in these pages.

It is therefore interesting to note that the Italian Government, through its embassy here, is making a thorough study of all State and Federal legislation of recent years covering the subject of the control of the sources of water power and the regulation of transmission and distribution in agricultural and industrial areas. Signor Montagna, chargé d'affaires of the embassy since November 7, 1905, has for years taken a deep interest in all matters of irrigation, harnessing of waterfalls, rivers and dams and their general regulation in the United States, and says: "The future of Italy is in water, if not upon the water. The whole length of the country is intersected by swift mountain streams at intervals of thirty to forty miles. The tributaries of the Po are even more frequent. As there is little coal in the country, large sums must be expended for foreign coal, the place of which could well be taken by the so-called 'white coal' supplied by the mountain streams, now running to waste." The whole railway system of Italy is eventually bound, he remarks, to be operated by electricity. In the same way energy will be supplied to factories. There are few countries in Europe, in this respect, more favorably situated than Italy, and her hold upon the industrial civilization of the future bids fair to be as lasting as was the hold upon the early political civilization, exercised by Rome, which still in matters of religious faith, is the dominant city of the world.

The Circle Diagram and Induction Motor Design.

In articles appearing in this journal for April 21st and May 26th of this year, Dr. A. S. McAllister showed that the error involved in assuming the locus of the vector representing the primary current of the induction motor to be a simple semi-circular arc is well defined and practically negligible. He has

also shown that this semi-circular diagram applies both to polyphase and to monophase induction-motors. The article in this number on page 284, by Mr. A. M. Gray, takes up the inverse proposition and shows that, assuming the semi-circular diagram of the induction motor, it is easy to compute and lay off the semi-circle for any particular size and speed of induction motor, designed according to the rules which experience has indicated to be serviceable.

The first step is to find from the assumed power, speed and starting torque of the motor under design, its pole-pitch, air-gap, and Behrend leakage-factor. From this the full-load power factor is known, and the point of tangency of the semi-circle and the current lag angle are determined. Next, the center of the semi-circle is deduced very simply, and the semi-circle can be drawn. The constant losses allowed for the motor finally enable the origin of the vector primary current to be located. The primary and equivalent level secondary resistances are swiftly arrived at and the remainder of the design follows along a clearly blazed trail.

It does not seem too much to say that by the use of the simple semi-circular diagram the design of the induction motor appears to be made as simple as the design of a direct-current motor. If, however, the full and more precise formulas are adhered to, the design of an induction motor is considerably more complicated, and requires more preliminary trial than the direct-current motor. The use of the semi-circular diagram well illustrates the differences between applied and unapplied, or pure, science. The latter is blindly indifferent to labor, holding truth and accuracy above all other considerations. Short-cut methods are looked upon askance, and the Q. E. D. is the coveted laureate crown upon any inquiry, no matter how long and erudite. It is well, perhaps, that this should be the case. If undue haste were to carry the steps of pure science beyond the strict stepping stones of logic, more time might be lost in retracing steps over false conclusions than were saved in original speed of advance. But with applied science, the whole series of concepts, and order of ideas, is different. We aim at the attainment of practical concrete results with the minimum of effort. The short-cut is not merely tolerated, but is hailed with delight, provided that experience in actual trial shows the error made in direction is not serious from a human and utilitarian standpoint. By deliberately ignoring a small error, an enormous saving in labor may be effected, and the results may be just as effective or useful; although, of course, not so closely correct. In pure science, we deal with what we suppose to be the thoughts and ways of the infinite; but in applied science with the ways of men.

TO WIRE OR NOT TO WIRE.

In no question pertaining to central station policy is there a more radical difference of opinion among central station managers than whether the central station company should undertake wiring contracts for customers or whether this should be left to outside contractors. Along with this goes the question whether the central station company should carry in stock and retail a line of electrical supplies. If anyone doubts that there are radical differences of opinion on these questions, he should read the answers in the National Electric Light Association Question Box printed in our July 7 issue. The question has many sides to it and the radical differences of opinion expressed are doubtless due to varying local conditions. Against the central station company entering the contracting and supply business there are the following arguments. By so doing, the central station company becomes a competitor of independent contractors and supply dealers in a town, and therefore is not so likely to have the good will of these contractors. It is better to have the contractors and dealers working for the central station company than against it. The central station company's bids on competitive wiring jobs are usually higher than those of other contractors if the central station company maintains a high standard of work and looks for profit. This in itself is likely to create a bad impression on the public as a company which bids high on a job of wiring the public may naturally conclude charges too high prices for its electricity, although the difference in bids may be entirely due to differences in quality of work. The carrying on of a contracting business involves considerable trouble and attention to detail in proportion to the profits (if there are any profits). On the other hand, those in favor of contracting and supply dealing by central station companies present some strong arguments. In many towns there are no thoroughly responsible wiring contractors, the business having fallen in the hands of irresponsible men with no capital, who do not stay in a place for any length of time. This results in a lot of bad wiring which is an injury to the central station business. It is seldom that independent contractors have the permanent welfare of the central station business in a town at heart as does the company, and they are more likely to put up cheap and unsatisfactory work. In some towns there is only one contractor, and competition is necessary to keep his prices within reason. In other towns combinations of contractors have forced prices up to a point where the central station has had to take a hand to prevent its growth of business from suffering. A great many people naturally look to the company for wiring and supplies, and it facilitates matters to a certain extent if a company is in a position to meet all the wants of a customer so that he will not have to go to more than one place to get all those wants supplied.

We will not attempt to say which set of arguments has the better of the discussion. One thing is certain, viz., that local conditions differ greatly. In some cities there are plenty of good contractors, while in others the central station company is practically forced into the contracting business. In some cases, the central station companies have fostered and encouraged an outside contractor to locate in a town. If a company does not do wiring, it should take great pains to see that possible new customers are promptly looked after by wiring contractors as soon as they express any desire to have work done. It is also well for the company to exercise some supervision over the quality of work done, and the design of a customer's installation both from the standpoint of convenience and illumination. It is undoubtedly a mistake for a central station company to attempt to secure a great profit on its wiring. While it may do this for a time when there is no other contractor in the town, nothing is easier than for some independent wireman to start up competition; and if the company's prices for wiring have been exorbitant, the public finds it out as soon as competition starts. The thing of greatest importance, after all, is that the central station company shall be progressive and have a firm control over the character of wiring which is being done in its territory. This control can be exercised in a number of ways. It may refuse to connect up with installations not properly put in. It may underbid unscrupulous contractors, or it may exercise a moral influence against bad work.

The Opposition to Scientific Advance.

The seventy-fifth annual meeting of the British Association opened at York, on August 1. Prof. Lankester in his presidential address reviewed the remarkable progress made in science in the last quarter of a century. It would, he said, stand out forever in human history as the period in which new chemical elements of astounding properties were revealed with extraordinary rapidity. The discovery of radio-activity and radium so far exceeded all others in importance that it might be accounted supreme. It was a privilege to have lived when the discovery was made.

Dr. Lankester summarized the properties of radium as revealed by Curies and others. He dwelt particularly upon the apparent facts that a small quantity of radium diffused through the earth will maintain its temperature against all loss by radiation, while if the sun consists of a fraction of 1 per cent of radium this would serve to replace the heat annually lost by the sun.

These, he said, were tremendous facts and upset all the calculations of physicists concerning the duration in the past and in the future of the sun's heat and the earth's surface and the estimates of geological time based on the assumption that the material of the earth is selfcooling. Within five years it had become evident that the material was not self-cooling. On the contrary it was self-heating, and away went the restrictions imposed by geologists and biologists, who are now willing to give, not merely a thousand million years, but as many more as are wanted.

Referring to psychology, Dr. Lankester said the most important general advance seemed to be the realization that the mind of the human adult is a social product, and he paid a tribute to the important work on this subject by Prof. Baldwin, of Princeton University. A review of twenty-five years led him to the conviction that Darwin's conclusions as to the origin of species were more firmly established than ever despite the attempt to controvert them.

Political administrators, as well as permanent officials, were as unaware to-day as they were twenty-five years ago of the vital importance of science. Whole departments in which scientific knowledge was the one thing needful were carried on by Ministers, secretaries and clerks who were not only ignorant of science but disliked it because in many cases it was a condemnation of their official employment. Dr. Lankester added:

"The reason is to be found in the defective education, both in the school and the university, of the English governing class, as well as in the racial dislike of all classes to the establishment and support of public funds of posts which the average man may not expect, by popular clamor or class privilege, to gain for himself. The only remedy is improved education for the upper classes and a continued effort to spread knowledge of the results of science and love of it among all members of the community."

Municipal Electrical Supply Throughout Ontario.

In accordance with an act of the Ontario Legislature, a commission was appointed to inquire into the "feasibility and desirability of securing the establishment and operation of municipal power, heat and light works." This commission has just issued its official report concerning the cost of installing a power plant at one of two possible sites selected on the Canadian side of Niagara, and of transmission lines to the seven municipalities directly interested, together with the cost of energy delivered at these municipalities. It is estimated that the total present power consumption of the seven municipalities is about 60,000 kw, and that the present consumption of eleven other municipalities within transmission distance is about 20,000 kw. The annual savings to the municipalities, estimated as the difference between existing costs and the costs that would follow a 75,000-kw municipal development, would be $1,860,000, or about 63.5 per cent of the present costs. The commission strongly recommended that the proposed enterprise be taken up and pushed to completion.

Prof. R. A. Fessenden, as technical member of the commission, prepared for publication with the report some interesting and valuable observations on various phases of the power development question. He stated that the price to be paid by the people for the preservation of Niagara Falls in its original state should be estimated in the same way as the price of any other artistic luxury. This price is not less than $120,000,000 per annum. It is a matter for serious consideration whether, at the same cost, results of more benefit could not be obtained in other directions. Objections that have been raised to the construction of a power house so near the walls, because it will interfere with the scenic effect, would be met in the present case by excavating for the power house and constructing it so that it will be below the level of its surroundings, and invisible.

In discussing the generation and transmission of electrical energy by the municipalities, Prof. Fessenden stated that, considered from an engineering standpoint solely, there is no reason why the municipalities concerned should not undertake the work; the present case is one in which no marked improvement in generation is possible, and there is no danger that the capital invested will be lost through the development of new and cheaper methods. Electric lighting does not, however, from an engineering standpoint, fall within the class of undertakings which can be efficiently and properly operated by municipalities. On account of the numerous improvements which are being made in systems of electric lighting, both arc and incandescent, an electric lighting plant may become obsolete in a few years. There are indications that a considerable number of municipalities which have engaged in electric lighting are entering upon a period of financial difficulty.

In the proposed undertaking the engineering work is of a comparatively simple character. The hydraulic and electrical apparatus have been standardized. The character of the rock to be excavated for the tunnels and wheel pits is known. The transmission line is also of a type which is now standard, and there is nothing experimental about any part of the engineering work. It is not possible for any great improvement to be made in methods of generating electricity from water power, as the present methods utilize nearly all of the available power. The proposed power plant and transmission system can, therefore, be safely undertaken with the assurance that there is no possibility of the equipment becoming obsolete through inventions having an appreciably greater efficiency.

Lightning During 1905.

In reply to a circular letter asking for information in regard to lightning troubles during 1905, a committee of the National Electric Light Association received letters from 113 companies giving much valuable data as to lightning protection. Two-thirds of the companies have been practically free from trouble. The money value of property destroyed has been extremely small, the principal loss being due to interruption of service. The freedom from trouble has been due to the increased use of lightning arresters and largely to the high grade of insulation in modern transformers and generators.

There has been quite a little trouble with burned-out graphite resistances in lightning arresters. Carborundum and other mixtures are used in the latest types, and resistances of these materials seem to be constant and do not fly to pieces as the graphite rods do. The wire resistances in the low-equivalent arresters have also burned out in several cases.

No argument for or against the use of choke coils can be deduced from the replies received, for the main generating stations have had few burn-outs. Many series transformers on station switchboards have been burned out, both in stations protected by choke coils and in those unprotected. A considerable part of the discharge must have passed the choke coils to burn out this apparatus. Experiments have shown that choke coils reduce the strain on the ends of the windings of generators or transformers, and they should therefore prevent this apparatus

from receiving as high a potential strain as that required to break down the arresters.

Overhead ground wires are rarely used. On distribution lines they are a menace to the linemen and have been taken down, after trial, by several companies. Barbed wire is especially troublesome. The benefit derived from overhead ground wires on distribution lines is doubtful. On transmission lines they are of undoubted service. The few companies that use them report that they are well satisfied, and some are even enthusiastic. It is still a disputed question as to whether they are worth the cost. There is danger of trouble from breaking of these ground wires unless they are of very heavily galvanized iron or heavy copper wires, and either of these would add considerable to the cost of a line. One argument for overhead ground wires is that the poles and insulators are protected thereby. Only 25 per cent of the companies replying to this question have had poles struck, and on the poles struck few insulators were broken. One pole was struck for every 2,860-kw capacity of station. One pole was struck for every 19 miles of high-tension transmission line and one insulator was broken for every 62 miles. Interruptions to service due to broken insulators are very rare and are confined to special localities.

Mr. N. J. Neall, of Boston, said he did not know anything which had been contributed in recent times which went to the point more directly than this report. He thought, however, that it was just a beginning. One cannot tell how protective apparatus behaves by one year's observation. He thought the matter should be carried along for at least three or four years, and a very good thing to do in this connection would be to have special plants selected because of their vulnerability to discharge, and have them even more carefully watched than in this case. He thought certain important items were omitted from the classification which could have been added to it. For example, the number of lightning storms per system. There should also be given the percentage of the total arresters installed which are lost by reason of failure. Another important point omitted was the lightning arresters per point at which power is delivered. The importance of protective apparatus is greater when the line is used for distributing power over large territory with 1,000 transformers than with nothing but a power house, transmission line and sub-station.

Mr. H. C. Wirt, of Schenectady, in discussing this paper, said that it gave data that the manufacturers cannot very well give as to the comparative results on several different kinds of arresters. He thought the investigation should be divided between moderate voltages and high voltages. He would say that 5,000 volts and under should be counted in a distinct class.

Municipal Enterprises in American Cities.

In Bulletin 50, the Bureau of the Census continues the series of annual reports presenting official statistics of cities having a population of over 30,000. This bulletin covers the year 1904, and is limited to statistics of the financial transactions, debts, and properties of the cities, together with their area and population. The data thus collected and tabulated make possible interesting comparisons between the several cities as regards the total cost of municipal government, of schools, of police and fire departments, of sewers, streets, and other public works; also as regards the revenue from taxes, loans, or other sources, and the indebtedness, sinking funds, etc.

The bulletin states that great difficulty was experienced in obtaining comparable statistics of the cost and value of municipal public industries, principally because of the lack of uniformity in methods of public accounting. It is believed that the figures obtained constitute the best comparative exhibits of the kind yet compiled, and that the publication and criticism of the results will lead to still further improvements, including the adoption of more uniform methods of accounting, so that in the future the Census will be able to obtain accurate and comparable exhibits of all the costs and present values of public properties.

Of the municipal industries, by far the most important are the water works. They are reported by 108 of the 151 cities, and their value constitutes 63.8 per cent of the aggregate value of all municipal industry properties. The cities of over 100,000 population not owning water works were San Francisco, New Orleans, Omaha, New Haven, St. Joseph, Scranton and Paterson. Of the $8,000,000 invested in electric light works, Chicago reported about one-half. Others of the larger cities owning such plants were Detroit, Columbus, Seattle, Grand Rapids, Nashville, Holyoke and Tacoma. Nearly all of the $31,000,000 invested in gas works was reported by Philadelphia. Toledo, Richmond, Duluth, Holyoke and Wheeling were the only other cities owning such works.

In the reports of seven cities are found receipts or expenses on account of conduits for pipes and wires—Philadelphia, Baltimore, Buffalo, Springfield, Mass., Erie, Utica and Newcastle. Four cities were shown to be in the irrigation business—Denver, Los Angeles, Salt Lake City and San Antonio; three had toll bridges—New York, Covington and La Crosse; and two were operating municipal ferries—Boston and Portland, Ore. The only city running a stone quarry and crusher was Auburn, N. Y., and the only one having a municipal asphalt plant was Detroit.

The aggregate value of the properties of all municipal industries as here reported was $790,570,726. The 151 cities have already met from general revenues nearly one-half the cost of their industrial plants, but still owe 53.4 per cent of the total value.

The aggregate debt of the 151 cities at the close of the year was $1,531,462,655, and debt less sinking funds, $1,228,216,933, more than one-fourth greater than the national debt. The per capita debt less sinking funds was $56.97. Of the individual cities, the largest per capita net debt was reported by Newton, Mass., $125.58; the second largest, by New York, $113.25; the third, by Boston, $107.17, and the fourth, by Pawtucket, $104.19. Only ten other cities had a per capita net debt of over $75. Of the cities of more than 100,000 inhabitants, San Francisco had the smallest per capita net debt, $15.56. Of the cities between 30,000 and 100,000 Sacramento had the smallest, $5.81.

Failure of Municipalism at Hamilton, O.

More than local interest attaches to the following from the *New York Times* of August 1, in regard to the scandals, already noted in these columns as connected with the municipal ownership enterprises at Hamilton, O. The article says: "Marked with evidence of mismanagement, extravagance, and unbusinesslike methods in the operation of public properties placed in their charge," are the terms in which the official report to the State Auditor of Ohio characterizes the operation of the municipal gas and electric plants of the City of Hamilton, Butler County, by the Board of Public Service. The report, which is a valuable contribution to municipal ownership literature, covers the period from Jan. 1, 1903, to Jan. 1, 1906, and a perusal of it indicates that much stronger terms than those quoted above would have been justified in characterizing the operation of the city's heating and lighting plants. One indictment found by the Public Auditor against the administration of the city lighting plant was "the employment of inexperienced men"—a polite term for political heelers—"to superintend important work, where both mechanical and electrical skill were necessary." The report continues:

"In the electrical department the enormous waste of energy owing to faulty construction, has raised the cost of production of current to an abnormal figure. The operation of the gas works has been far from economical, and it is an established fact that the cost of production of light and power from both utilities has at times exceeded the schedule rate charged for the service. The examination of the books of the electric-lighting plant for the three years covered showed this point clearly. At the conclusion of the first year, 1903, the balance on hand was $2,362.45. The operations for 1904 showed a deficit of $1,993.73, and reduced the balance to $368.72. For 1905 a credit balance was shown only by excluding over three thousand dollars of unpaid bills, the actual loss shown on Jan. 1, 1906, being $2,063.70. The surplus of $2,300 on hand at the beginning of 1904 had been transformed into a deficit of almost equal amount two years

later. The city gas works began the year 1903 with a surplus of $3,252.44. During 1903 and 1904 the expenditures exceeded the receipts, and on Jan. 1, 1906, the Auditor's examination showed a debit balance of $13,431.61.

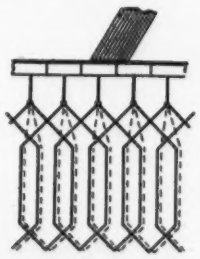
"Graft in the coal supply is shown to have been carried on in a variety of ways. It was found that there were hundreds of duplicate coke sale tickets in existence on which the numbers had been filled in with pencil and that the originals were missing. The stubs from the sales book for a period of over three months were missing also, so that it was impossible to furnish any check in the receipts of the city from this source. There was a shortage in the Secretary's accounts, and the surety bonds of a number of officials had not been renewed for a number of years, so that there was no means of recovery by the city for losses for which they might be responsible.

"Petty grafting by employes from sales and purchases, however, was insignificant in comparison with the big graft that went on at the city's expense in both gas and electricity. This was where the politicians came in. Free light and heat for everybody with a pull seems to have been the rule. In the words of the report, 'officials, ex-officials, prominent citizens, and others were enjoying free service; while these accounts were duly charged on the books, apparently no effort had been made toward their collection or adjustment. Several individual accounts ranged from one hundred to eleven hundred dollars.' Although names are not mentioned in the report, which is concerned only with the administration of the municipal plants, it was brought out by the investigation that some of the 'prominent officials' were saloon keepers and all were active in politics and connected with the local ring. At the beginning of the year there was found outstanding more than $35,000 of these uncollected accounts, an amount equal to the entire yearly receipts of the municipal electric light plant.

"Until the recent investigation the citizens of Hamilton had been exceedingly proud of their gas and electric plants, and they had often been pointed out as an example of successful municipal ownership and operation in the United States. When William J. Bryan visited the city during the political campaign two years ago he was much interested in learning about the city's experience in municipal ownership, and he asked a number of questions about the operation of the plants. It is said that his desire to know the details proved very embarrassing to the city officials and that they found it convenient to change the subject as quickly as possible."

Preventive Resistance for Alternating-Current Commutator Motors.

The accompanying illustration indicates a method for preventing sparking in alternating-current machines of the commutator type, as disclosed in a patent issued July 3 to Mr. Marius Latour. In electrical parallel with each armature coil is placed a certain

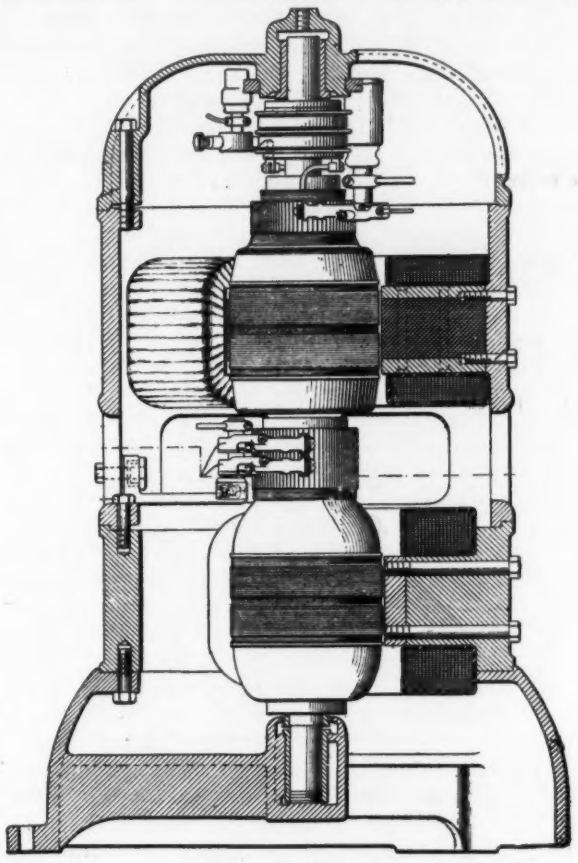


ARRANGEMENT OF PREVENTIVE RESISTANCES.

high resistance which is arranged to allow the current to be reversed in the individual coils as they pass under the brush without sparking. The resistance is in each case located in the same slots in which the corresponding coil is placed, and is so wound that the two coils are mutually non-inductive, consequently the voltage induced in the auxiliary resistance will be in a direction to assist the reversal of the current. This method is intended for use with motors in which the armature runs almost in synchronism with a revolving field, such as with the Latour compensated repulsion motor.

Compact Motor-Generator.

The accompanying illustration shows a method of arranging a motor-generator so as to minimize the floor space required by it, as described in a patent issued July 31, to Mr. L. A. Tirrill. The armature of the motor is direct connected to that of the



TIRRILL DYNAMOTOR.

generator, the shaft being placed in a vertical position. The set illustrated, which is intended for use in signal towers, consists of a direct-current motor above which is mounted a self-exciting alternating-current generator, the field rings being directly connected together in order to economize both material and space.

Hydro-Electric Power and Electric Railways.

The chief interest in the regular work done by the Street Railway Association of New York State at its recent Saratoga meeting lay in the papers on hydro-electric power, as summarized below.

Mr. G. A. Harvey, in his paper on "Contracting for Use of Hydro-Electric Power on Railway Systems," stated that as water is available and costs no more if used to the full capacity of the plant, it is plain that the selling company will strive vigorously for a uniform load as high as is practicable for the installed machinery to carry. The conditions at Niagara are unique on account of the electrochemical plants which provide an ideal load and consume the greatest part of the power now developed. One of the oldest plants has a 24-hour load line of about 26,000 hp, the fluctuations not exceeding 5 per cent of the average load. The most common method is to sell a block of "firm power," which can be used at a load factor of from 70 to 80 per cent, charging the minimum rate for this, and providing power above the "firm" amount upon a kw-hour basis at rates gradually increasing with the height of the peaks.

In discussing the sale of energy from the power companies' point of view, Mr. C. E. Parsons contended that it is not reasonable to expect a railway manager to consider a proposition unless there is a saving over the cost of operation by steam, and the stumbling block in the way of a contract is usually the amount of this saving. There are two methods which may be considered in making contracts for railway energy. One is the flat rate per

horse-power per year, based on the maximum demand; the other method is on the kw-hour basis. In either case a fixed amount of power is agreed upon as the maximum load, and momentary overloads of 5 per cent or 10 per cent are allowed. With the flat rate method, in order to obtain the benefit of the cheap energy, the railway company must make an investment either in a storage battery or in an auxiliary power plant and bear the interest and depreciation of the same, while with the kw-hour method the rate of the railway company is higher, but the power company bears the interest and depreciation of the apparatus which is idle part of the time, but which must be maintained in readiness to supply the maximum demand.

Mr. S. B. Storer outlined a convenient method for determining the rate to be made for service, in which there is a certain minimum charge per year per maximum measured horse-power and a variable charge depending directly upon the load factor. The load factor is computed on the basis of a 24-hour day; the kw-hour consumption per day, divided by 24, is taken as the average demand; dividing this average demand by the maximum demand gives the load factor for that day. The average of the highest daily one-minute peaks occurring during any month is taken as the average maximum demand for that month and from this value is ascertained the load factor. The proposed method may be expressed in the form of an equation, as follows:

$$R = A + L\,(B - A),$$

where R is the desired rate per year for the maximum measured horse-power; A is the minimum rate per horse-power per year when the load factor is zero; B is the maximum rate when the load factor is unity, and L is the load factor.

In reply to the possible criticism as to the difficulty in measuring the maximum demand, the author stated that a maximum demand meter capable of fulfilling the requirements can be devised if there appears to be sufficient market for one. In small installations the maximum demand may be taken as the rated capacity of the apparatus installed, and an ordinary watt-hour meter may be used for observing the consumption per month for determining the load factor.

The three papers on hydro-electric power were discussed by several members. Mr. Cole, of Elmira, remarked that on an average plant of, say, 5,000 kw, there would be a firm load of from 3,000 kw to 3,500 kw, and a peak of 5,000 kw would run half an hour to an hour. In carrying such a load on an auxiliary steam plant it would be necessary to charge up, say, 20 cents per kw-hour for the peak power. On many roads, in summer, it is necessary to start up 30 to 40 cars in, say, half an hour, yet this may come only twice in 24 hours. With an electric light plant, many large office buildings come on for about an hour a day, yet the companies must pay for the 24 hours on account of the load above the firm load line.

Mr. Harvie, of Utica, and Mr. Wilson, of Buffalo, agreed that the kilowatt-hour basis for hydro-electric power was the sound one. The latter objected to any peaks whether one minute or two, and Mr. Harvey, of Buffalo, figuring out the case for that place, found that it was $30,000 a year more expensive than on the kw-hour basis.

Mr. Storer remarked that so far as the question of selling power on a kw-hour basis pure and simple with a guaranteed load factor is concerned, the consumer runs against the same thing as on the maximum demand basis. From the Niagara, Lockport & Ontario Power Company's standpoint, that company considered it much more to the consumer's advantage to be permitted to take these peaks and pay for them only when they occur, rather than have the circuit-breakers throw off the entire load and interrupt the service if only for a few minutes. According to Mr. Cole's remarks on peak loads, he counts the load he gets in the summer time for the park service as put on as an addition over the firm load line. On top of that he puts the lighting load from buildings and some other kind of power service. The chances were that in Mr. Cole's particular case the park load in the summer time will come at a time after the ten-hour factory load is off. It will also come at a time when the lighting load in offices is not a factor. Therefore, taken as a whole, the same law of probability would enter in that case. The point of measurement being the same for all of these different usages, the total peak would be very much reduced below the individual peaks of each class of service supplied by the buying company. Therefore, the retail company could oversell this purchased block of power in the same way that a power company can oversell the capacity of its plant.

Mr. Allen, of Utica, said a good deal of the satisfaction depended on the form of contract. In the past five years the Utica & Mohawk Valley Railway Company has had three forms of contract, two unsatisfactory and the third satisfactory. It has been operating under the latter since July 1, 1905, and it has proved mutually satisfactory. The first contract was for block or firm power to be paid for at so much per horse-power per year, measured by a horse-power meter. The maximum demand for the month was to be regarded as 75 per cent of the average maximum demand, and was to be paid for at the rate of $25 per horse-power. All power in excess of this 75 per cent was to be paid for at $33 per horse-power per year. That was not satisfactory either to the railway company or to the power company, and was repudiated by both. As an arbitrated agreement the railway company purchased power for two years on the kw-hour basis, the railway company having no power plant that it could use. The price in that contract was so high that instead of paying 16.66 per cent of the gross receipts for power, the railway company paid 32.8 per cent for two years. The present contract is not wholly a kw-hour contract. The railway guarantees a minimum load per month, and if the total kw-hours used in one month do not clear a certain amount the railway must pay the minimum anyway. There has been but one month when the total kw-hours used have fallen below the minimum.

Mr. Wilson said the International Railway had two forms of hydro-electric contracts, one for the city lines and the other for the Lockport interurban division. In Buffalo the railway pays a certain price per horse-power per year for 7,000 firm hp. In summer the company shuts down the steam plant. The company pays for peak loads at a certain rate per kw-hour. In the winter the railway carries the peak load with a steam plant and batteries. On the interurban contract the company pays a certain price per horse-power-year, and has a sliding firm line such as Mr. Harvey recommended, and excesses are paid for at a certain price per kw-hour. The total cost per kw-hour is $.0067. The price for Buffalo the speaker considered high. It is a long-term contract which was entered into some time ago when the power business was new and the railway was new. The speaker believed the price per kw-hour given compares favorably with modern steam plants. He asked concerning the cost of energy in New York City. Mr. Root, of the New York City Railway, replied about $.006 per kw-hour.

Regulation of Maximum Lighting Rates.

At Cincinnati, O., on August 1, the United States Court sustained the injunction which stops the city council of Columbus, Ohio, from forcing the Columbus Railway and Lighting Company to limit its charges for electric light and power to not more than five cents per kilowatt hour. The ordinance fixing that rate was passed by the council in 1904. The company resisted the reduction, alleging that the new price would not allow any profit on its investment. It was shown by the evidence that the five cents per kilowatt hour rate would require the company to furnish electricity at cost to 75 per cent of its patrons and at less than cost to most of the others.

The court concurred in the opinion that this amounts practically to confiscating property and is in violation of the Federal Constitution. While the city council has the right to fix the charge for electricity it cannot put it so low as to leave no fair return on its investment to the electric company. The injunction against the city council is made permanent.

The case was reported quite fully in these pages on June 16, when the decision of the special master, now sustained, was given in abstract. His conclusions were: 1. The court has jurisdiction of the case and power to grant the relief prayed for. 2. Meters, arc lamps and incandescent lamps are a proper part of the property account of complainant, and their repair, renewal and main-

tenance is a proper charge against its operating expenses. 3. The amount which complainant could have earned upon a fair valuation of its property during the year 1904, had the ordinance been in force, was not a fair compensation within the meaning of the law, and for that reason said ordinance, if enforced, would have deprived complainant of its property without due process of law. 4. The fact that 75 per cent of complainant's customers under the rate fixed by the ordinance would receive their light at cost, or, less than cost, including depreciation, is in itself a violation of the constitutional rights of complainant, and deprives complainant of its property without due process of law. 5. For the reasons above stated, the ordinance of July 5, 1904, is unconstitutional in that its enforcement would deprive complainant of its property without due process of law, and deny to complainant the equal protections of the laws, and, therefore, the injunction should be made perpetual.

CURRENT NEWS AND NOTES.

RAILWAY DEPOT TELEPHONES.—The corporation commission of Virginia has taken steps to enforce the act of assembly requiring all railroads to maintain telephones in their ticket and freight offices, and the commission has issued an order to the roads giving until September 1 to install the telephones for use of passengers and patrons of the roads.

TRAIN TELEPHONY.—The low grade freight line of the Pennsylvania Railroad from Harrisburg to Atglen was completed last week and found satisfactory by a party of officers who were on the first train to be run over it. The line will be divided into 11 sections and operated by telephone, it being the first long section of steam road in this country to be thus controlled.

MILAN EXPOSITION FIRE.—A serious fire occurred at the Milan International Exposition on August 3, early in the morning, causing a loss in the Palace of Decorative Arts of over $2,000,000. The fire was at first attributed to electricity, but the Milan Edison Company reported that it had no live circuits there; and the authorities are investigating the reports of revenge on the part of dissatisfied employees. Many original documents relating to Volta are said to have been destroyed.

EXPERIMENTS IN THE NAVY.—M. Schneider, an electrician on the Wasp, has equipped that vessel with a wireless telegraph outfit at his own expense. The apparatus sends messages thirty-five miles and has received them from points thirty miles away. The commandant of the Training Station at Newport recommends to the Navy Department that the electrician be permitted to communicate with other ships and continue his experiments. This plan has been approved by the chief of the Bureau of Equipment.

OLD TIME TELEGRAPHERS.—The Old Time Telegraphers and Historical Association and the Society of the United States Military Telegraph Corps will meet for the twenty-sixth annual reunion at the Arlington Hotel, Washington, October 9, 10 and 11. The president of the Old Timers is Mr. W. H. Young, of Washington. The local chairman of the hotel committee is Mr. R. G. Callum, of the Western Union Telegraph Company, and Hon. P. V. De Graw is chairman of the reception committee.

PORTABLE WIRELESS SET.—Under the direction of Capt. George S. Gibbs, who is in charge of the signal work at Mount Gretna, Pa., a portable wireless set for field use will be thoroughly tested. The entire equipment for each station of the system will weigh only slightly more than 300 pounds, and the weight of the sectional mast, which is sixty feet high, is only about fifty pounds. Two mules can readily pack the complete equipment for a station. The sectional masts are so made that they can be raised in a short time by a small detachment of men. The sections are light and the mast will be raised by adding sections at the bottom and steadying the pole by ropes until it is elevated to the proper height, when it can be made fast and a tent erected at is base to shelter the sending and receiving apparatus.

BELL TELEPHONE BEES.—It is reported from Greenwich, Conn., that bees there have been giving the telephone linemen a lot of trouble in the last few days, and many of them have been stung. A swarm has been busy in the telephone box high up on a pole in East Elm street, and drove the linemen off when they tried to open the box and adjust things inside. The bees entered through the keyhole, and filled the interior of the box with the choicest honey. Another swarm took possession of the box cornice, at the Elms, a boarding house in Putnam avenue, and after several guests had been stung the proprietor determined to get rid of them. On one farm, near Belle Haven, the foreman is a Southern boy from the mountains of Virginia. He had been used to handling bees. In a few moments he had all the bees corralled, and had bagged ten pounds of the honey.

CHICAGO MUNICIPAL LIGHTING.—The ninth annual report of the department of electricity of the city of Chicago, issued by Mr. William Carroll, city electrician, states that the city has spent for construction and operation of its municipal plant since 1888 $4,748,890. Adding interest at 4 per cent amounting to $1,463,957, the total cost of the city lighting service is given as $6,212,847 for that period. The report then figures that it would have cost the city $6,687,910 had the lamps been rented at $103 a year, which is the price paid by the city to the Commonwealth Electric Company for very scattered lighting in outlying districts. It seems absurd, however, to assume that the entire arc lighting of a great city like Chicago would have cost $103 per lamp per year during the period mentioned simply because that is the price paid for lighting the outlying districts where lamps are very much scattered.

ELECTRICITY IN CHINKIANG.—A report from the Chinese city of Chinkiang says: "In October electric light was introduced into the extensive Chinese suburb between the British concession and the city. The credit of its introduction is due to the enterprise of a remarkable individual, Mr. Chang Chien, a native of Tungchow, in this district, who having, when in humble circumstances, won the highest and most coveted literary rank of chuangyuan, or optimus, in the palace examination, has employed the influence so acquired in promoting the manufacturing industries of his native town and vicinity. He is an ardent supporter of the principle that China can and should manufacture for herself the fabrics now imported in such enormous quantities from abroad, and, having no capital of his own, he has had the ability to convince men of high position and wealth to entrust him with means of putting his views into practice." At a suburb of Tunchow there are a large number of cotton and other factories that are driven by steam power and lighted by electricity.

NUMBER OF WIRELESS STATIONS.—The wireless telegraph stations in the world have been located and catalogued by the Bureau of Equipment of the Navy Department, and soon will be published in a small book. The systems of wireless are also given. The number of stations in each country are: Belgium, 1; Denmark, 4; Germany, 13; France, 6; Great Britain and Ireland, 43; Holland, 8; Spain, 4; Portugal, 1; Gibraltar, 2; Italy, 18; Malta, 1; Montenegro, 1; Norway, 1; Austria-Hungary, 2; Rumania, 2; Russia in Europe, 8; Sweden, 3; Turkey, 6; Argentina, 5; Brazil, 5; Canada, 5; Chile, 1; Costa Rica, 1; Mexico, 2; Panama, 2; Uruguay, 1; United States, 88 (of which ten are in the possessions of the United States, and thirty-two directly under the control of the navy); Trinidad, 1; Tobagol, Andaman Islands, 2; Burma, 1; Hong-Kong, 1; China, 5; Hawaii, 6; Japan, 2; Dutch East India, 5; Russia in Asia, 1; Egypt, 2; Morocco, 2; Mozambique, 2; Tripoli, 1. The compilation also gives the names of all the merchant ships equipped with wireless. This list shows apparently over 250 stations in operation throughout the world.

TELEPHONY IN CHICAGO.—The Bell telephone system in the Chicago territory reports 158,874 telephones in use, and a gain of 1,552 in July.

ASSOCIATION MEETING.—Mr. Rolland A. Davidson, secretary of the Empire State Gas & Electric Association, announces that the annual meeting will be held in New York City on Friday, October 12.

THE JAPAN CABLE.—The new commercial cable, whose completion to Japan was noted recently in these pages, was opened to the public on August 1, for regular business between that country and the United States.

BELGIAN TELEGRAPHS.—The railways, posts, telegraphs and telephones, owned and operated by the Belgian Government, showed an increase of $2,000,000 in receipts last year as compared with 1904. The details are not given yet of the telegraphs and telephones, which are also usually treated as one service.

PRESENTED TO THE KING.—At Buckingham Palace on July 27 King Edward received as representatives of the American Institute of Mining Engineers, Robert W. Hunt, R. W. Raymond, C. Kirchhoff, Walter Wood, Joseph Hartshorne, Theodore Dwight, B. F. Fackenthal, Jr., and Oberlin Smith. The party were accompanied by the officials of the Iron and Steel Institute. The Bessemer Medal was presented to the King, who expressed his pleasure at receiving it from the representatives of such an important industry.

PITTSBURGH LIGHTING.—Some of the councilmen in Pittsburgh are discussing a municipal plant. The controller's table shows all the lamps used by the city, whether in lighting the streets or the public buildings, as follows: Electric arc lamps, 3,247; incandescent electric lamps, 4,340; vapor lamps, 3,791; artificial gas lamps, 3,114; natural gas lamps, 112; total, 14,604. Under an agreement with the gas companies the city gets 12,500,000 cubic feet of illuminating gas free each year. Dr. H. B. Burns, who strongly favors a municipal lighting plant, thinks that nothing should be done until there is a decision on the Greater Pittsburg bill, because, he argues, the municipal lighting plant in Allegheny could be enlarged so that light could be furnished for both cities.

GROWTH IN NEW YORK.—The public consumption of electrical energy in New York City is making remarkable strides. The excellent *Bulletin* that the New York Edison Company issues says in its August number: "During the month of June, 1906, the net Manhattan Island increase in the service of The New York Edison Company was 895 customers, 32,330 incandescent lamps, 558 arc-lamps, 3,825 horse-power in motors, and some miscellaneous apparatus in storage batteries and heating appliances, which resulted in a total gain of 95,515 equivalents of 16 candle-power. The system now supplies installations aggregating 4,153,723 equivalents of 16 candle-power, of which 122,234 horse-power are in electric motors. During twelve months, ending with June, there has been a net gain of 8,992 customers, 381,184 incandescent lamps, 4,746 arc-lamps, 24,389 horse-power in motors and additional apparatus, which brings the total gain to 763,493 equivalents. These figures relate only to Manhattan Island."

CAR BRAKES IN ENGLAND.—Mr. Albert Halstead, who succeeded his brother, Mr. Murat Halstead, as United States Consul at Birmingham, makes his first report on the practical subject of the American opportunity for electric car brakes in Great Britain. He writes: "While the speed of electric cars in the United Kingdom does not average as high as that of similar cars in the United States, there seems to be a growing danger to passengers on the British street cars by reason of the increasing use of electricity as propelling power. Accidents have occurred lately in the United Kingdom from cars getting beyond the control of the motormen, in the most recent of which three people were killed and a number injured. Authorities who have control of the running of electric cars in the Kingdom are now inclined to insist upon better and more effective brakes for such cars, it being argued that recent accidents would have been averted had the cars been supplied with suitable brakes. It would seem as if this attention to the question of proper brakes on electric cars should offer an immediate opportunity for American manufacturers of electric car brakes of all standard kinds to push their sales in the United Kingdom."

MUNICIPALISM IN MINNESOTA.—A municipal ownership proposition has been up at Staples, Minn., and the Northern Electric Company, which is interested in the plant, has issued a neat, terse little pamphlet dealing with the plan to sell $62,000 of bonds for this and kindred purposes. The new plant for lighting would require $20,000, and it is shown that this would be quite inadequate, making, for example, no provision for meters. The company makes the following reasonable offer: 1 Enlarge and remodel present plant. 2. Install thoroughly modern electrical apparatus of such capacity as to adequately care for the lighting of houses and streets and pump city water. 3. Rewire the city, putting in new poles where necessary. 4. Change the price per arc lamp per year from $80 to $75, installing as many new lamps as the city may require from time to time. 5. Place arc lamps in center of street to give greatest possible light in all directions. 6. Give free incandescent lamp renewals. 7. Pump city water at the rate of 4½c. per horse power per hour. 8. Assume care and operation of pumping apparatus. 9. Guarantee good service. Any complaints to be immediately investigated. 10. At the termination of our franchise, the plant will be for sale to the city at such price as may be set by arbitration.

THE WIRELESS CONFERENCE.—A dispatch from Washington says: "Brig.-Gen. James Allen, chief of the Signal Corps of the army sailed for Europe on August 4, where he will investigate the signal service in various foreign armies preparatory to attending the international conference on wireless telegraphy which will convene at Berlin on October 3. Charlemagne Tower, American Ambassador to Germany, will represent the State Department at that conference; Rear-Admiral H. N. Manney, United States Navy, retired, will represent the navy; Gen. Allen will be the army representative; and John I. Waterbury, of New York, who is now in Europe, will represent the Department of Commerce and Labor. Nearly every great Power will be represented at the Berlin conference, which will take up the work of intrnational regulation of wireless telegraphy where it was left by the preliminary international conference held in Berlin in 1903. Germany, Austria, Spain, United States, France, Hungary, and Russia were signatory to preliminary agreements then framed as the basis for an international convention regulating wireless telegraphy. Since then most of the other nations of importance have signified their intention to participate in such a convention."

WIRELESS STATIONS.—At no distant date the United States Navy will have the Pacific Coast equipped with wireless stations as the Atlantic Coast is now equipped. Wireless stations have been completed and equipped at San Diego, Arquello, Faralona, and Mare Island. Faralona is just outside of San Francisco Harbor, and the station was located there in order to have the communication over sea, as much as possible from one station to the other. Stations are now being constructed at Table Bluff, Cape Blanco, North Head, and Cape Flattery. The stations are from 130 to 210 miles apart, and when they are all erected and the apparatus installed it will be possible to communicate the whole length of the Pacific Coast either in the day or night. In this connection it may be noted that after thorough experiments the government has determined that the earth formation at Montauk Point is not suited to successfully operate a wireless telegraph station. The present station is to be abandoned and all apparatus shipped to Fire Island, where a new station will be built. A De Forrest wireless telegraph station is being constructed at Saulte Ste. Marie, Ontario. It will have, it is claimed, a capacity of sending and receiving 600 miles over land and 2,000 miles over water in daytime.

SEATTLE MUNICIPAL OWNERSHIP.—A special election will be held September 12 to vote on the proposed municipal ownership of the street railroad system, outlined by the city engineer, at an estimated cost of $7,579,980. A bond issue, to be authorized later, is part of the programme.

CHICAGO TELEPHONE RATES.—The Chicago Telephone Co. has made reductions in charges and other concessions in the way of improved service. Under the new schedule the company sells 600 calls per year for $60, a reduction of 20%, and for additional calls there is a graded charge of 6, 5, 4 and 3 cents. The charge for private exchange boards will be reduced 50%. This affects 1,500 subscribers with 3,500 telephones.

TREAD AND FLANGE OF WHEELS.—The American Street & Interurban Railway Association has issued a data sheet dealing with the subject of the tread and flange of wheels on street railways, having a special committee for standardization of this item. The information obtained will be carefully collated by the engineering committee, and together with other material upon this subject, will form the basis of its report on the standardization of brake shoes. It is believed that the work under way will be of much value to street and interurban railway interests, and the co-operation of engineers and managers is invited.

A FEMALE "MOTORMAN."—In Chicago last week a woman suddenly pushed a street car motorman from his platform, seized the controller, and sent the car flying through the streets at a pace that endangered the lives of a considerable part of the city's population. Fortunately nobody was killed, and only a few coal carts were tossed lightly from the track. When at last the woman was dragged from her place by the police and the car had been stopped, it was discovered that she was a suburbanite anxious to catch her train. She was released on making this extraordinary explanation of her not less extraordinary performance.

PHONOGRAPH BURGLAR ALARM.—The idea of a phonograph watchman's clock was suggested many years ago. According to advices from Pittsburg, Mr. John C. Hood, of Wilkinsburg, is the inventor of an electro-phonographic device which calls up the police station when a burglar tries to get into the house. It tells the man at the police end of the telephone to hurry along with the wagon and take the robber away. When the burglar forces a door, window or other opening where the device is placed the machine, which is worked by electricity, is set in motion, and a phonograph, located in the garret, where connection between the telephone wire and the wire connected with the burglar alarm has been made, calls "central" and asks in plain English for the police station. When connection with the police station has been secured the phonograph informs the police as to the street and number of the house that is being robbed, and repeats the information as long as the receiver is off the hook.

METRIC ABBREVIATIONS.—The French Minister of Public Instruction has decided that all teachers throughout France are in future to employ the following distinctive abbreviations for the various weights and measures: For denoting length —myriametre, Mm; kilometre, Km; hectometre, Hm; decametre, dam; metre, m; decimetre, dm; centimetre, cm, and millimetre, mm. For areas—hectare, ha; are, a, and centiare, ca or m^2. For measures of bulk (timber), decastere, das; stere, s or m^3, and decistere, ds. For measures of mass and weight—tonne, t; quintal metrique, q; kilogramme, kg; hectogramme, hg; decagramme, dag; gramme, g; decigramme, dg; centigramme, cg, and milligramme, mg. For measures of capacity—kilolitre, kl; hectolitre, hl; decalitre, dal; litre, l; decilitre, dl; centilitre, cl, and millilitre, ml. The use of the capital letters for the three largest denominations of length are intended to prevent confusion, and all the other abbreviations follow on uniform lines. The employment of full stops between the letters is officially abolished, and k. g. for kilogramme and m. m. for millimetre disappear.

THE WORD "TELEGRAPHONE."—The subjoined item from the *Telegraph Age* is timely and pertinent. The growth of the art is creating many difficulties of this character. For example, the new Cahill electric music system speaks of its wonderful apparatus as the "telharmonium" and the "dynamophone"; and it is evidently casting around for new and appropriate terminology. The *Age* says: "The misuse of the word 'telegraphone' is apt to create wrong impressions as to its true meaning, and consequently lead to confusion and error. For instance, the term as it is generally employed in this country, especially in railroad and telegraph circles, where, indeed, it is most frequently met with, applies in brief to a telephone circuit attached to an ordinary telegraph line. In Europe, on the other hand, and even to a certain extent here in America, an understanding of the word is held to denote the device of Poulsen, which is, as a matter of fact, no more or less than a form of phonograph or graphophone, for the instrument records speech on a metal band. As the definition of the word now coming more freely into usage is so diverse in meaning, it would seem that a change might properly be made by the adoption of a new title for one form of interpretation." The American Institute of Electrical Engineers might do worse than appoint a committee on electrical terms and phrases, for purposes of standardization.

ELECTRIC LOCOMOTIVE SPEED.—So far as electrical engineers were aware, there has been no great difficulty in determining exactly and scientifically, the speed of elctric locomotivs, but the *Railway Age* thinks differently. It says "One of the puzzling difficulties which will confront the steam locomotive engineman who is placed in charge of the modern electric locomotive designed to haul through passenger trains on steam lines, such as those now being delivered to the New York Central Railroad, will be to discover a method of judging speed. The man at the throttle, with a throbbing engine under him, has a number of ways of knowing unconsciously the speed of his engine, even in the dark. He can tell instinctively from the tempo of the various rhythmic motions of the engines almost with exactitude his rate of progress without glancing at watch or mile post. Or in daylight he knows sub-consciously from the very fact of having had under his eye for years the revolutions of his driving wheels or the movement of reciprocating parts, almost precisely the speed per hour which their motion represents. The electric engine has no reciprocating parts; it is rigid, moves noiselessly and with very little vibration. Apparently the only way in which the speed can be judged is by careful attention to the rapidity with which the objects at a given distance from the track are passed."

ELECTRICAL EXPORTS.—Reference was made editorially in these pages last week to the comparative figures of export of electrical machinery from this country and from the United Kingdom. Discussing the statistics, the bulletin of the U. S. Department of Commerce and Labor says: "Our exports of electrical machinery in 1904 were threefold those from the United Kingdom—$7,409,200 and $2,545,200, respectively. Our largest exports were to Canada ($2,023,900), Japan ($1,239,900), and Mexico ($1,037,300). This not only shows the advanced position of the development of these three countries, but it shows that the trend of all countries eager to develop their industrial resources is toward the employment of electrical machinery. Unless some power superior to electrical energy should supervene, electrical machinery and electrical appliances of all kinds will dominate the industrial future. It therefore only remains for American electricians to cater to the world's requirements to hold the lead they have already won in this great branch of the machine industry. When the amount of electric machinery in use in the United States is taken into consideration, if such were possible of conception, that we should have an export thereof valued at $7,409,200 in 1904 is really wonderful, and that the United Kingdom should be our third largest consumer thereof shows that our greatest markets are in the most advanced countries, these only being capable of handling this new power and reducing it to the industrial uses."

Electrical Canal Towage in Germany.

THE Teltow Canal, near Berlin, Germany, which was recently opened to traffic, offers much that is of more than passing interest as regards the application of electricity to inland waterways. The canal connects the river Spree, at a point about 15 km above Berlin, near Grunau, with the Havel (Glienicker Lake.) It is about 38 km long and extends in an approximate east-west direction. The width is about 21 meters on the bottom and admits of the passage of boats of 600 tons register and drawing about 1.88 meters of water.

The original purpose of the canal was to drain certain suburbs of Berlin; later it was decided to make a commercial waterway of it and thus to relieve the congestion which then existed along the waterways between Berlin and Potsdam. In addition to the through traffic, it is expected that a considerable business will be developed along the canal itself, and to this end harbors have been built at five different places along the route.

The main line of the canal (there are two short branches, one at each end), passes through a number of suburban towns and is crossed by no less than three railway bridges and 37 highway bridges.

The difference in level between the upper Spree and the Havel is taken care of by a single system of locks situated at a point about 8.5 km from the Havel end of the canal. The water level at the Havel end fluctuates between 28.97 and 30.54 m., while the level at the upper side of the lock is held almost constantly at 32.28 m. by an overflow dam across the Spree at Berlin; thus the difference in level at the locks fluctuates between 1.74 and 3.31 m.

These locks, which are very elaborate, have been designed to operate with a minimum amount of water. There are two locks placed side by side and separated by a wide masonry wall. The locks are filled and emptied through a system of conduits situated inside of this wall. In order to save water, the connections are so arranged that half the water used by a down-going boat can be emptied into the other lock and thus assist in raising a boat which is going the other way. In order to restrict the amount of water to a minimum, the government required that the lock be fitted with hoist gates and a centrifugal pump of one cu. m. per sec. capacity, for pumping water from the lower to the higher level during the low water season.

The hoist gates, of which there are four in all, are operated each by a 15-hp, 200-volt, three-phase induction motor running at 600 r.p.m. The motor is started with an auto starter, and it requires just 60 sec. to raise the gate to full height (8.27 m.) from the time the starter handle is turned. The gate is counter-balanced with a variable weight and controlled by a magnetic brake. The motor is kept in circuit, both when hoisting and when lowering the gate, and is protected, in case of accident, by a centrifugal automatic stop.

A gate, operated by an 8-hp, 220-volt induction motor running at 580 r.p.m., is installed in the middle wall so as to permit the passing of water from the high to the low level in times of high water.

At each end of the locks, and extending 140 m. along the middle of the canal, is built a trestle work upon which are laid two parallel tracks. Upon these tracks are operated crane carriages, each weighing about 1,500 kg and driven through two sets of gears by an 11-hp, 600-volt continuous-current motor running at 1,050 r.p.m. With these carriages the boats are towed into and out of the locks. The current is led to the motor in the manner which is usual with cranes of this type. The time required to transfer a boat from a point about 350 m. from one end of the lock to a point at an equal distance from the other end, is one-half hour, and, since both locks can be operated simultaneously and each lock will accommodate two boats, the tonnage handled per 10-hour day is 32,000 tons, allowing 400 tons per boat.

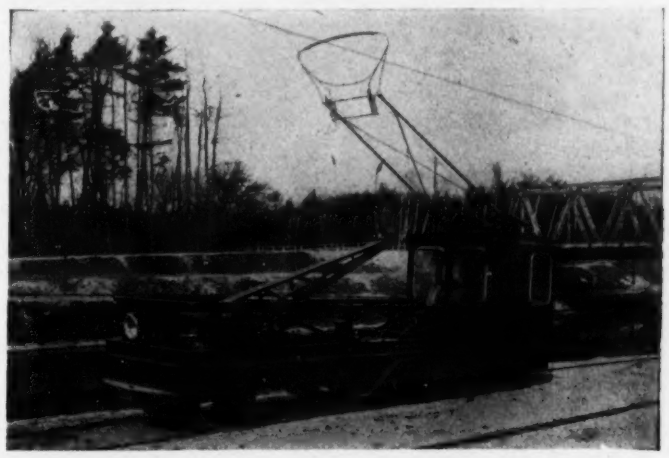


FIG. 2.—TOWING LOCOMOTIVE.

FIG. 1.—LOCOMOTIVE IN OPERATION, TOWING TWO BARGES.

From the very start it was evident that some system of mechanical towing must be resorted to. It was desired to have a system which could handle the boats quickly, and at a minimum cost, and at the same time have no ill effects upon the banks of the canal.

In view of the success attained in the early Nineties by the

Siemens & Halske Company in experiments with an electric locomotive on the Finow Canal, it was decided that a locomotive could be designed which would fulfill the requirements of the case at hand.

After studying the requirements, an ordinary tractive locomotive operating on a 1 m. gage track, was adopted. It was designed to pull two fully loaded boats (1,200 tons) at 4 km per hour; to be fitted with a tow line guide which would carry the tow line free of any obstructions, on the bank, such as

FIG. 3.—LOCOMOTIVE TRUCK EQUIPPED WITH TWO MOTORS.

loading boats, etc., and all auxiliary apparatus was arranged to be operated electrically under the control of one man. This locomotive was built and tested during the Fall and Winter of 1903 and 1904, with the following general results.

At 4 km per hour, and a pull of 0.85 kg per ton of cargo, a power consumption of 0.014 kw per ton and an energy consumption of 3.5 kw-hours per ton per km was obtained. At 4.5 km per hour the corresponding figures were found to be: 1,035 kg per ton; 0.021 kw per ton, and 4.25 kw-hour per ton per km. At 5 km per hour: 1.34 kg per ton; 0.0284 kw per ton and 5.25 kw-hour per ton per km. The mean efficiency of the locomotive was 65 per cent.

The general construction of the locomotive can be seen from the illustrations herewith. It is supported upon a four-wheel truck and a pair of trailing wheels. Each axle of the four-wheel truck is driven through two sets of gears by an 8-hp, 500-volt series motor, running at 800 r.p.m. The motors are designed to run continuously at full load.

Upon the rear end of the carriage, immediately over and parallel to the axle of the trailer, is mounted a shaft which carries the guide arm with which the tow line is manipulated. This guide arm is raised and lowered by a 3-hp motor which is connected through a pair of bevel gears and a screw to the arm.

The tow line (10 mm wire rope) is passed through the eye of the guide-arm and wound upon a drum situated at the forward end of the carriage. This drum is driven through a worm gear by a 3-hp motor, running at 1,460 r.p.m. The drum itself is not fastened rigidly to its shaft, but is held by a friction coupling which can be controlled by hand. The coupling is generally so adjusted that a pull of 1,200 kg can not be exceeded without slipping. It requires about 2,000 kg pull to start a 600-ton boat, so that when starting the drum will slowly slip and thus allow the locomotive gradually to assume its load.

The tendency of the pull on the tow line to tip the locomotive over backward and toward the canal is counteracted by raising the rail nearest the canal 2 cm above the other and by so distributing the apparatus on the locomotive that most of the weight will come at the forward end and at the land side. The driving motors are both on the land end of their respective axles, and all auxiliaries are carried on the land side of the locomotive. The result of this careful distribution of the weight is as follows: 1,900 kg on each of the driving wheels on the land side, 1,380 kg on those on the canal side, and 550 kg and 390 kg on the corresponding trailer wheels. The total weight of the locomotive is 7,500 kg.

There are two long lakes in the path of the canal and along these sections it was found impracticable to attempt to use the locomotives; therefore some form of tug boat had to be adopted. In order to determine the kind of power equipment most suitable, many experiments were made.

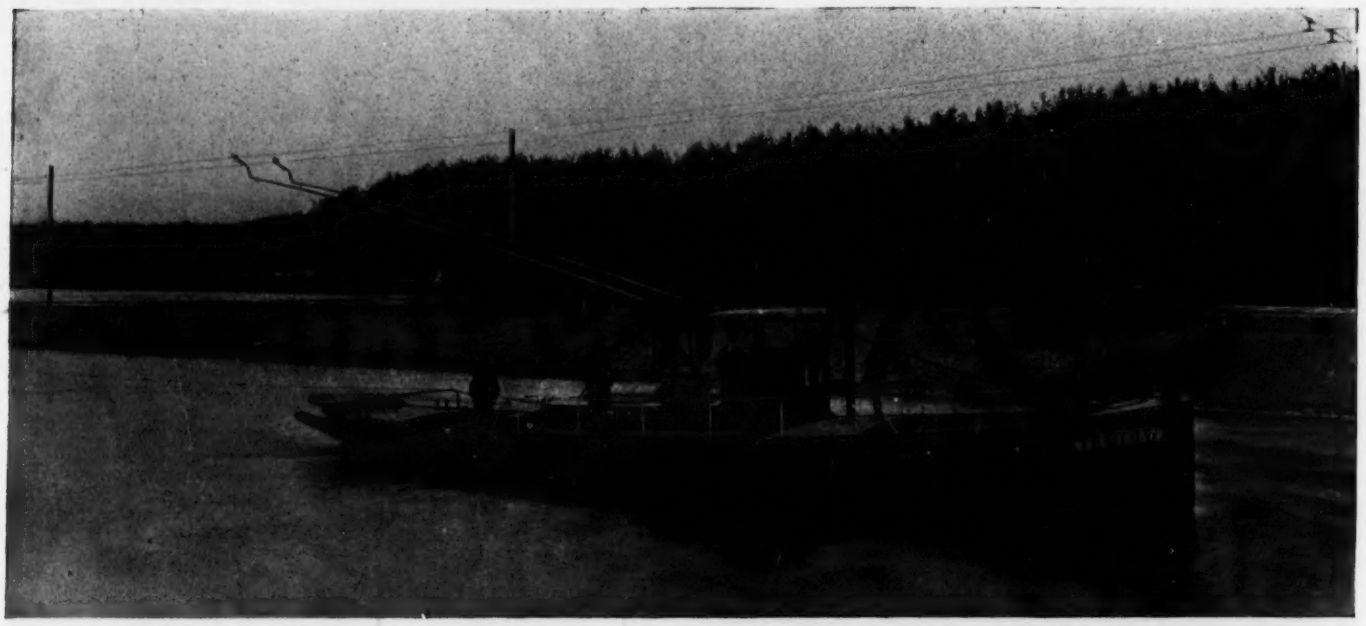


FIG. 4.—VIEW OF EXPERIMENTAL BOAT RECEIVING CURRENT THROUGH TWO ORDINARY TROLLEYS.

To begin with, the Siemens-Schuckert Company placed a triple screw electric tug boat at the disposal of the experimenters.

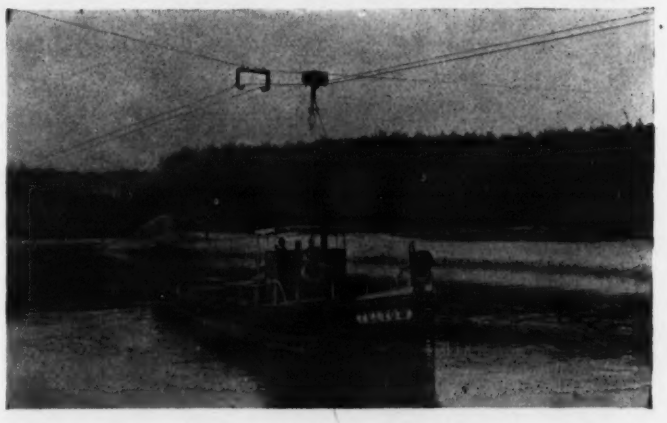


FIG. 5.—EXPERIMENTAL BOAT WITH MOTOR-DRIVEN TROLLEY.

The boat is divided transversely into six compartments. Commencing at the bow the first and last are used as trim tanks, the second, third and fifth hold a storage battery of 220 elements

having a capacity of 244 amp-hours, discharging in five hours. The total weight of the battery is 11,000 kg. In the fourth compartment, three series motors are installed. The middle motor develops 25 hp and the two outside ones 20 hp each. All are direct connected through flexible couplings to the propeller shafts, and since the speed fluctuates between 202 and 536 r.p.m. very carefully designed propeller screws of small diameter had to be used.

The advantages of having three screws are twofold: First, less wash is produced along the bank; second, they can be used to manoeuvre the boat.

The boat was equipped with two kinds of current collectors, namely, the ordinary double-trolley and the Lombard-Gerin motor-driven trolley. The first was not a success because it could not be kept upon the wires and much time was lost in replacing it. The second consists of a small carriage driven by a small three-phase motor, the current for the motor being obtained by tapping the armature of one of the series motors and connecting the taps to slip rings on the motor shaft. The frequency of the current was therefore proportional to the speed of the series motor and the speed of the trolley was proportional to the speed of the series motor. This scheme works admirably on a locomotive where there is a positive relation between the speed of the motor and that of the locomotive, but on a boat where the speed of the boat depends upon the load which it is pulling, as well as upon the speed of the motor, the trolley motor will run ahead when the tug is towing loaded boats and run behind when it is towing light loads.

In order to remedy this defect, a small synchronous, three-phase converter was installed to furnish three-phase current for the trolley motor. With this arrangement the frequency would be adjusted at will by regulating the field strength of the inverted converter. This was also a failure because of the great sag in the trolley wires; the motor would run slowly up the incline and rapidly down so that it was pulling first one way and then the other on the cable connection.

In spite of the cleanliness, the ease of attendance and manipulation, etc., the electric power tug had to be abandoned on account of the excessive cost. The experiments showed that at a speed of 4 km per hour, the energy consumption was 9 kw-hours per ton-km and the total efficiency of the boat was 22 per cent.

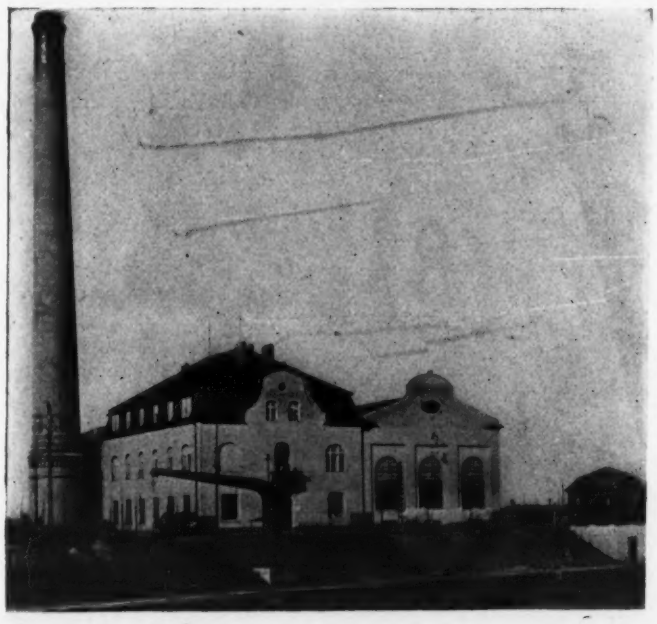


FIG. 6.—VIEW OF EXTERIOR OF POWER HOUSE.

Experiments were also made with boats equipped with other kinds of power, namely, alcohol engines, gas engines, and steam with oil-fired boiler.

The first boat was driven by a 60-hp Daimler alcohol motor, and required 0.01 kg of alcohol per ton per kilometer. Assuming the cost of alcohol to be 5 cents per kg, the cost of operation, exclusive of the lubricating oil, was 0.05 cents per ton per km.

The gas engine equipment was found to be even less applicable to the purpose. The steam tug with the oil-fired boiler was the one finally adopted, as it required only 0.5 kg of fuel oil per hp-hour. Assuming the price of oil to be 0.85 cents per kg, it would cost 0.01 cent per ton per km to run a 100-hp boat at 4 km per hour when towing a 1,200-ton load (two boats).

Since the canal could not be operated during the night hours and would be closed entirely for at least two months every year, it was evident that a power house built for the operation of the canal alone could not be profitably run, and for this reason it was decided at the start to build a central station, and sell electricity to small industries which might be built up in the neighborhood. It is intended to make the price so low that new industries will be attracted.

FIG. 7.—VIEW OF INTERIOR OF POWER HOUSE.

The capacity of the present station is 2,300 hp, provision having been made to increase this to any desired amount by the addition of new units. The power required to operate the canal will vary between 0 at night and in the winter to 500 hp in the best season, assuming a total traffic of 2,000,000 tons per year.

The station contains three units; two 1,000-hp turbine units to carry the average load, and a 300-hp reciprocating engine unit for Winter and Sunday loads.

The boiler plant consists of four water-tube boilers, each being fitted with a superheater, which can be cut in and out of service at will. Each unit has 205 sq. m. heating surface in the boiler proper and 60 sq. m. in the superheater and is rated at 3,600 kg of superheated steam per hour at 300° C and 12 atmospheres (12 kg per sq. m) pressure.

The turbines are of the Zoelly type, built by Escher Wyss and Company in Zurich. Each unit consists of two turbines: One high pressure and the other low pressure; each containing five runner discs. The speed is 3,000 r.p.m. Jet condensers are used, the pumps being driven by three-phase motors. Owing to the great abundance of condensing water, a working vacuum of 95 per cent is maintained.

The turbines were guaranteed by the makers to carry full load (1,000 hp) with 6.1 kg of steam per hp-hour; three-quarter-load with 6.5 kg per hp-hour; and half-load with 7.1 kg per hp-hour. Although the official tests have not yet been made, the preliminary tests show that the actual steam consumption is, in every case, from 0.8 kg to 1 kg less per hp-hour than that specified by the makers.

The reciprocating engine is a tandem compound having 8.40 mm stroke and running at 125 r.p.m. The valves are of the positive acting poppet type so often seen on the Continent. A jet condenser, similar to the ones used with the turbines, is also used with this engine.

During the first year not more than two units will be in use so that on the same shaft with each prime mover there is mounted an alternating-current and a continuous-current generator. However, all units which will be added later will have only one generator per prime mover.

The generators are of the three-phase, 6,000-volt, 50-cycle revolving-field type for the alternating-current, and of the 600-

volt, compound-wound, inter-pole type for the direct current.

The capacity of the three-phase machines is in each case proportioned to that of the prime mover, while the capacity of the continuous current generator is proportioned to the requirements of the canal locomotives. Each three-phase turbo generator has a capacity of 650 kilo-volt amperes and the slow-speed generator has a capacity of 230 kilo-volt amperes, while the corresponding continuous-current machines have capacities of 200 kw and 110 kw respectively.

The load imposed upon the station by the locomotives, unlike the ordinary railway load, is an unsually steady one, due to the fact that the locomotives seldom stop but pull almost continuously with full power on.

In view of this fact, it was not deemed necessary to install a floating battery, the compound winding of the generators being relied upon to take care of all fluctuations in voltage. However, after some experimenting, the compound winding was found to be of so little advantage that it was disconnected. A small storage battery of 36 cells having a capacity of 126 amperes was installed to excite the alternating-current generators when starting and also to light the station in case of an emergency. The regular exciters are 32-kw, 65-volt, shunt generators driven by 50-hp, 220-volt, three-phase induction motors, running at 960 r.p.m.

Continuous current is to be used for the operation of the locomotives, for the towing carriages at the locks and for trolley roads, should any desire to purchase power. The alternating three-phase current is to be used for lighting and all auxiliary power purposes.

There is one sub-station near the east end of the canal, which at present is equipped with two 150-kw synchronous converters running at 1,000 r.p.m. The distribution system possesses no points of special interest.

Electric Smelting.

At the July meeting of the Faraday Society, Dr. Eugene Haanel, of the Department of the Interior, Ottawa, presented a "Preliminary Report on the Experiments Made at Sault Ste. Marie, under Government Auspices, on the Smelting of Canadian Iron Ores by the Electro-Thermic Process." The experiments described were made for the purpose of amplifying the results obtained at La Praz and Livet by the Canadian Commission in 1904, in view of the special conditions obtaining in Canada.

The furnace was of the Héroult type; it absorbed 5,000 amp. at 35 to 40 volts (power factor 0.919), being fed from a transformer of 225 kw capacity. The official experiments lasted nearly two months, and during that time 150 casts were made, yielding 55 tons of pig iron. The experiments indicated that under normal conditions about 11.5 tons were produced by an expenditure of 1,000 electrical hp-days; with an improved furnace of, say, 1,500 electrical hp capacity, a figure of 12 tons should, it is stated, be reached. The mean figure provisionally adopted by the Commission was only 7.8 tons per 1,000 electrical hp-days. The consumption of electrode was about 18 lb. per ton of pig iron; it was greater for white than for grey iron. The results obtained are summarized as follows:

(1) Magnetite (which is the chief Canadian ore) can be as economically smelted by the electro-thermic process as hematite. (2) Ores of high sulphur content not containing manganese can be made into pig iron containing only a few thousandths of 1 per cent of sulphur. (3) The silicon content can be varied as required for the class of pig to be produced. (4) Charcoal, which can be cheaply produced from mill refuse or wood which could not otherwise be utilized, can be substituted for coke as a reducing agent, without being briquetted with the ore. (5) A ferro-nickel pig can be produced practically free from sulphur and of fine quality from roasted nickeliferous pyrrhotite. (6) The experiment made with a titaniferous iron ore containing 17.82 per cent of titanic acid permits the conclusion that titaniferous iron ores up to perhaps 5 per cent titanic acid can be successfully treated by the electric process. The paper concluded with an estimate of Dr. Héroult for a 10,000-hp plant capable of producing 120 tons of pig iron in twenty-four hours.

The Circle Diagram and Design of Induction Motors.

By A. Miller Gray.

THE two articles on the circle diagram which have recently appeared in the Electrical World, April 21 and May 26, suggest a very simple method for obtaining the preliminary design for an induction motor. For a given type of machine the following values can be determined by experience:

$$\Delta = \text{air-gap of motor} = .008 + \frac{d}{1{,}000} \text{ inches.}$$

$$a = \frac{d^2 l S}{P}.$$

$$C = \frac{\sigma \tau}{\Delta}$$

where d = inside diameter of stator core in inches.
l = length of stator core in inches.
τ = pole pitch in inches.
σ = leakage factor, as defined by Mr. Behrend.
S = speed in r.p.m.
P = output in horse-power.

The curve of Fig. 1 shows the relation between a and P.
The curve of Fig. 2 shows the relation between C and P.
Fig. 3 shows the circle diagram to be used for the design of a

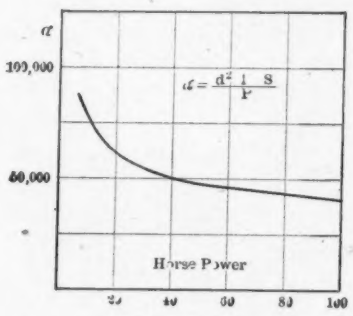


FIG. 1.—CURVE SHOWING RELATION BETWEEN a AND P.

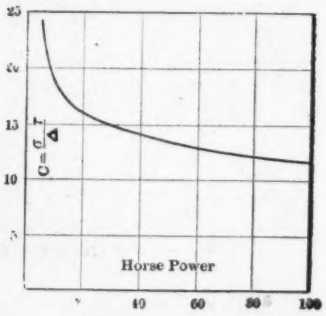


FIG. 2.—CURVE SHOWING RELATION BETWEEN C AND P.

three-phase induction motor of the following rating: 12-hp, 550-line volts, 1,200 r.p.m., 60-cycle, motor to have maximum power

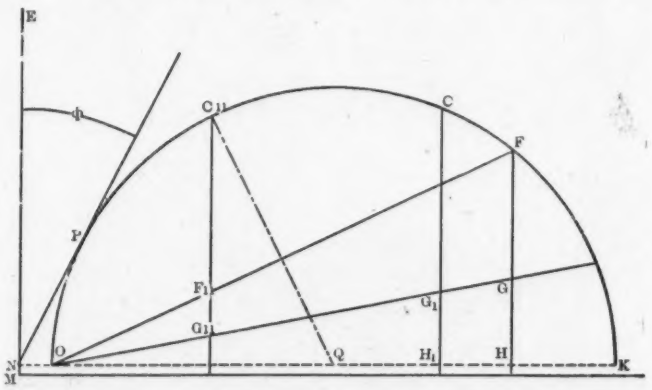


FIG. 3.—CIRCLE DIAGRAM FOR A TWELVE- HORSE-POWER, THREE-PHASE INDUCTION MOTOR.

factor at full load, and to have a starting torque of 15 synchronous hp.

Efficiency at full load assumed = 84 per cent.

$$\text{Number of poles} = \frac{60 \times 120}{1{,}200} = 6.$$

$$a \text{ from curve} = 70{,}000 = \frac{d^2 l \times 1{,}200}{12}$$

$$d^2 l = 700$$

$$d = 12\tfrac{1}{2} \text{ inches}$$

$$l = 4\tfrac{1}{2} \text{ inches}$$

$$\tau = \frac{12\frac{1}{2} \times \pi}{6} = 6.55 \text{ inches}$$

$$\Delta = .008 + \frac{d}{1{,}000} = .02 \text{ inches}$$

C from curve $= 18$

$$\sigma = \frac{18 \times .02}{6.55} = .055$$

Maximum power factor $= cos\,\Phi = \frac{1}{2\sigma + 1} = .90.$

$$\text{Full load current} = \frac{12 \times 746}{.84 \times .9 \times \sqrt{3} \times 550} = 12.4 \text{ amp. per lead.}$$

Referring now to the construction of the circle diagram of Fig. 3,

$$NQ = \frac{NP}{sin\,\Phi} = \frac{12.4}{.43} = 29$$

$$ON = NQ - \tfrac{1}{2}OK$$

$$= NQ - \frac{ON}{2\sigma}$$

$$ON\left(1 + \frac{1}{2\sigma}\right) = NQ = 29$$

$$ON = 2.87$$

Knowing these values, we can now draw the input circle, OCK. *To correct this ideal diagram for the constant losses of the motor:*

Friction and windage can be assumed as 5 per cent of input = 530 watts.

$$\text{Current to overcome these losses} = MN = \frac{530}{\sqrt{3} \times 550} = .56$$

amp. per lead.

To allow for primary copper loss:

The vertical distance between OG and OK is the value of the current to supply this loss.

Allow 5 per cent copper loss in primary = 530 watts.

$$\text{Primary resistance} = \frac{530}{3 \times (12.4)^2} = 1.1 \text{ ohms from terminal}$$

to neutral. To draw the primary loss line, take any value of current, $MC = 45$ amp., and measure along the perpendicular, CH_1, a distance

$$H_1G_1 = \frac{45^2 \times 3 \times 1.1}{\sqrt{3} \times 550} = 7 \text{ amp.} \quad \text{Join } OG_1.$$

To allow for secondary copper loss:

Since starting torque = 15 synchronous horse-power, it is required to find a point, F, such that $FG = \frac{15 \times 746}{\sqrt{3} \times 550} = 11.8$ amp. Join OF.

Maximum horse-power is represented by $F_{11}C_{11} = 16.8$ amp.

$$\text{Maximum } P = \frac{16.8 \times 550 \times \sqrt{3}}{746} = 21.5.$$

The performance diagram and the resistances of the primary and secondary windings being now given, the remainder of the design is comparatively easy, and may be found described in Behrend's book on "The Induction Motor."

A reference to the articles previously mentioned will show what assumptions have been made in the design of this motor, and it is unnecessary to point out how the construction can be altered to suit various cases that may come up.

Factors Which Influence the Character of Southern Water Power Development.

BY JOSEPH M. ROMAN.

AS was pointed out in a paper read by Mr. C. E. Waddell, at the Asheville meeting of the American Institute of Electrical Engineers, July, 1905, the water powers in the South are so numerous—and some are so variable—that, to prevent reckless competition and insure continuous service at or near maximum load conditions, success for the operating company is contingent upon its controlling all of the water power which can economically supply all of the territory that its development covers.

In some instances, also, splendid water powers exist in sections easily accessible to the coal fields, so that it must be borne in mind that any water power thus located must, to be financially successful, deliver power to compete with that derived from the high-grade steam coal brought in from the nearby Tennessee and Alabama coal mines. This necessitates development on a large scale, with operation and depreciation costs per unit of output reduced to a minimum, and also demands a continuous twenty-four-hour per day period of daily operation.

In considering water powers in the Southeastern Appalachian region we will first take up the important matter of fall line, which, throughout this region, is well defined—the streams, with but few exceptions, falling gradually from their mountain sources to the fall line. This gradual descent, however, includes shoals at various points in the stream, where the river may fall as much as 10 ft. in from one-quarter to one-half of a mile of its course. (There are instances of greater falls than this, but they are exceptions.) Shoals of from 6 to 10 ft. may be one or two miles apart, where the stream flows through a ridge, and thus a succession of shoals may occur. It is evident then that high heads do not exist; that flume and penstock development as a rule has no place, and that the form of development which, with very few exceptions, will be indicated, is the building of a dam at the most favorable location to back water over a succession of three or four shoals, possibly four to eight miles upstream, and thus secure a head at the point of development of usually between the limits of 35 to 50 ft.

The turbine cases, which are also the penstocks, are built with horizontal shafts in the dam, near one shore, in the abutment, and discharge through draft tubes which extend under the floor of an extension of the dam. The turbine shafts in most developments are parallel to the flow of the stream, and extend through the cases and beyond the dam wall. At the point where the penstocks are installed the dam is built of heavy concrete cement and masonry—no matter how the dam proper may be constructed. At this point also a bulkhead about 10 ft. higher than the remainder of the dam is erected, and the power house is constructed on an extension of this masonry portion of the dam, with the discharge tubes and tail race beneath it, and the turbine shafts extending into it, being protected from the river by the bulkhead of the dam which looms above it. The turbines in this form of development are, of course, horizontal, of the twin type, and the central line of the turbines is always about 25 ft. above mean water level in the tail-race. This gives an efficient use of draft tube and provides safety against the high back-water of freshets, to which all streams in this section are so liable.

The floor of the power house, which is often a portion of the dam abutment, is then constructed above tail-water at such a height that the central line of the generators, when resting on the power house floor, comes in line with the center line of the turbine shafts, to which they are direct-connected by a flange coupling. A sort of forebay is formed by blowing out the river bank; and by selecting a properly sheltered shore of the river so that wind and current tend to carry driftwood, trash, etc., to the other side, comparative freedom from this trouble is obtained.

The bulkhead then assists in forming the forebay and carries the racks, head gates and flood gates; it also serves to shelter the power house and apparatus. The floor and a portion of two sides of the power house are the abutments of the dam. While the bulkhead, as stated, is usually constructed of local rock and

cement mortar, the piers and arches forming and supporting the power house and the power house itself, are constructed of concrete.

One advantage in the construction of practically all Southern water powers is the fact that rock, sand and timber can be obtained in abundant quantities at the power house site; often gravel can also be there obtained.

The dam is usually constructed immediately above the location of the shoals where the development site has been selected, and by blasting the tail-race out to obtain an elevation of the bottom the same as that of the river bed below the shoals, a total head as desired is secured, and several feet in height of dam is saved, with other attendant savings. The dam itself can be constructed in various ways—log-crib and rock-filled, earth structure with masonry or concrete core-wall, reinforced concrete and rubble or cyclopean concrete. Naturally, in this, the basis of the entire development, it is impossible to secure too stable a construction, and yet, local conditions and the kilowatt capacity of the development really determine the kind of dam constructed. Thus at Morgan's Falls, Georgia (better known as "Bull Sluice"), on the Chattahoochee River, where 14,000 hp are developed for use in Atlanta, the dam is 48 ft. in height and is constructed of rubble masonry, large stones laid in concrete, with the upstream face of rubble masonry laid in Portland cement, while the downstream face is finished in Portland cement concrete. (For further details of this development, see Electrical World and Engineer, XLIV, No. 27, p. 1129.)

At Columbus, Ga., also on the Chattahoochee (where to-day a tremendous development, which will ultimately aggregate 75,000 hp, is contemplated), the Columbus Power Company is now developing 9,000 hp for municipal and manufacturing purposes. The dam is approximately 35 ft. high, and is constructed in the same way—of rubble concrete masonry—with a cut-stone spillway surface. (See Electrical World and Engineer, XLIII, No. 4, p. 165.)

At Albany, Ga., a smaller development just completed (and which is interesting because it is in practically level country 100 miles below the "fall line") on Muckafoonee River, where the dam is approximately 20 ft. high and is built of Portland cement concrete, 3,000 hp will be developed.

At Gainsville, on the Chattahoochee River, the first development of the North Georgia Electric Company is nearing completion and will aggregate 3,500 hp. The dam is a rock-filled, log-crib structure, 37 ft. high, with double-planked spillway, apron and upstream face. It is approximately 300 ft. long, stretching normal to the river flow. Another development of the same company on the Chestatee River, a tributary of the Chattahoochee, 15 miles from Gainesville, and which is designed to operate in parallel with the above-mentioned plant, develops 1,700 hp, the dam being also a log-crib, rock-filled structure, 37 ft. in height.

These powers, which are the most prominent ones developed in the State of Georgia, and a consideration of powers elsewhere, would indicate that for powers under 3,000 hp the log-crib, rock-filled dam is entirely satisfactory; for large powers a more stable form of masonry construction is essential. It should be borne in mind that the rock-filled type of dam is built of material found at the dam-site in every particular except the bolts that secure the logs together, which means a large and far-reaching economy.

The racks are supported by structural steel frames built in the abutment, and are gratings of 2-in. by ⅜-in. or thereabouts, laid on edge. The gates are immediately behind the racks, and are usually made of timbers laid crosswise, forming two courses, and work in steel grooves. They are operated by hand wheels on top of the bulkheads.

These few remarks will serve to convey a description of the type of power development which is adapted to conditions in South Carolina, Georgia and Alabama, and practically all plants will be of the type described. It is evident that water will be backed up several miles—in many cases eight to ten miles upstream—and hence the question of ownership and riparian rights involves many people and makes securing of options slow, tedious and expensive.

There are several developments contemplated in Georgia where this method of building will be changed. At Milledgeville, on the Oconee River, and situated on the "fall line," Furman's Shoals are located, where the river drops 15 ft. in 50 ft. of its course. It is proposed to build a 40-ft. dam above these shoals, back water for ten miles and thus secure a head of 50 ft., and drop the water on the turbines below the shoals by means of a canal and penstock. The variable nature of the river, its great width at this point and the lack of power users have retarded the development. It is stated that 6,000 to 8,000 hp can be developed. Another valuable development possible is on the Tallulah River in the northeastern portion of Georgia, in the foothills of the Blue Ridge. This fall takes the nature of a Western development. A fall of 335 ft. occurs in 4,000 ft. of the river course with a mean low water flow of 720 cubic feet per second, giving a gross horse-power of over 25,000. The ownership of the entire property is as yet unsettled, and within the range of economical transmission there is no market for any considerable power; but the great future value of this power is realized and efforts of several factions are being made for its control.

Flaming Arc Lamps.

At the recent Atlantic City Convention of the National Electric Light Association much interesting and valuable information was given concerning flaming arc lamps in papers presented by Mr. L. B. Marks and Prof. H. E. Clifford, respectively, as noted briefly in our issues for June 9 and June 16. We give below a more extended review of that portion of each paper dealing with the constructional features and operating characteristics of these lamps.

Prof. Clifford stated that it is only within a comparatively few years, and as a result of the scientific study of the arc, that it has come to be appreciated that the efficiency of such a light source is not dependent on temperature alone. The question of emissive power frequently plays an equal if not greater part in the determination of the ratio of watts to candle-power. It has long been realized that the light from the arc itself between pure carbon electrodes is of extremely low intensity, and more than sixty years ago experiments were carried on in substituting other electrodes in place of pure carbon. No systematic investigation of the whole question took place, however, until the recent work of Bremer, Auer, Nernst, Blondel, Whitney, Steinmetz, to mention the more noted of the workers in this field.

This work has resulted in marked improvements in two directions: First, the production of a luminous arc between electrodes whose rate of combustion is very much less than with ordinary carbons; and second, the evolution of the high-efficiency flame arc, in which the ordinary carbon electrodes are replaced by those impregnated with metallic salts. Although these impregnated carbons are to-day manufactured in many forms differing in construction detail, the purpose with all of them is to obtain a higher light efficiency. Up to the present time this gain in efficiency has been obtained at the expense of the life of the electrodes.

The color of the light with these carbons is determined by the nature of the salts used and may therefore be controlled throughout a wide range. The efficiency, however, is very different for the different salts, the calcium compounds having given the best results. This difference in efficiency is well illustrated by the curves of Fig. 1, showing the distribution with flame carbons giving light designated as white, red and yellow, respectively. The tests here indicated were made with a 20-amp. Siemens-Halske alternating-current lamp without globe, operating with 32.5 volts at the arc and 34 volts at the terminals. The watt consumption at the terminals per spherical candle-power varied from 1.202 for the white light to 0.716 for the yellow. From the standpoint of efficiency, therefore, the carbons producing yellow light are distinctly superior.

Fig. 2 shows the results of tests made upon a 10-amp. Excello direct-current lamp operated with 55 volts at the terminals and 46.3 volts at the arc without a globe and 49.3 volts at the arc with a globe. A comparison of the two photometric curves of Fig. 2 shows the importance of a careful study of the optical properties of the glass used, since its selective absorption may

bring about a considerable diminution of intensity for the very rays which are emitted by the arc.

In addition to the metallic salts for securing a longer and more brilliant arc, a flux is introduced to assist in the disposition of the slag formed. The presence of this slag makes it desirable in some cases to place the carbons parallel or slightly inclined to each other, rather than in line. In lamps where this arrangement is adopted, a magnetic blower coil maintains a longer arc under ordinary conditions of operation, and acts in addition to prevent the arc from climbing up the sides of the carbons. In a number of flame arc lamps, however, the carbons are placed one directly above the other.

The diameter of the carbons used varies from 8 to 11 mm., the negative being as a rule 1 mm. less in diameter than the positive. The length varies from 325 to 600 mm., whereas the life ranges from 7.25 to 17.5 hours. Lamps are now manufactured having a magazine to contain eight or nine pairs of carbons, thus giving a much increased time of burning.

Mr. Marks, in outlining the mechanical features of flaming arc lamps, stated that owing to the rapidity with which the carbons are consumed it has been found necessary to shield the tips as far as possible from "washing" of the air currents in the globe. For this purpose there is used an "economizer" or chamber of highly refractory material which surrounds the ends of the carbons (in lamps in which the carbons are arranged side by side) or encircles the upper carbon (in lamps in which the carbons are arranged one above the other).

The vapor which results from the burning of the mineralized carbons condenses for the most part on the economizer and con-

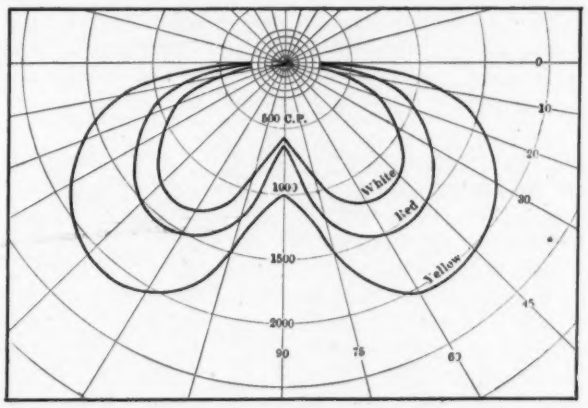


FIG. 1.—FLAME CARBONS. DISTRIBUTION OF LIGHT IN VERTICAL PLANE.

tiguous portions of the lamp casing. Sometimes a special form of condenser is provided to receive the vapor deposits. As the color of the condensed vapor is whitish the deposits above the arc assist in reflecting the light downward. The arc is extremely sensitive to currents of air in the globe and to variations in the magnetic field as well as to movements of the regulating mechanism of the lamp.

In the very nature of things the tendency of a long arc operated in the manner employed in flaming arc lamps is toward unsteadiness. The variability of air currents in the globe, the lack of uniformity in the chemical constituency of the mineralized carbon, and the action of the magnetic field (where such is employed)—these and other difficulties conspire to produce unsteadiness in the light.

For purposes of street illumination the highly efficient yellow light of the calcium carbon is in general suitable, but for interior illumination where color values are important the yellow light flaming carbon lamp is objectionable. Under the light of this lamp white material appears cream-colored, the shades of yellow are intensified, and the color values at the violet end of the spectrum are naturally distorted. It is quite impossible to distinguish different shades of dark blue from one another, all of them appearing black. With the white light flaming carbons, however, most of the colors have approximately their correct daylight value.

The distribution of illumination of the type of flaming arc lamps now in use is quite different from that of the enclosed arc lamp. Most of the light of the flaming arc lamp is thrown downward in a zone from 30 to 90° below the horizontal, the amount of illumination dropping off quickly toward the horizontal. The maximum illumination is at about 45° below the horizontal, in which respect the distribution of its light resembles that of the old open arc. The flaming arc, however, sends its rays with almost equal brilliancy through all the angles from 30 to 75° below the horizontal, while the old open arc quickly drops from its maximum on either side of the 45° line of vision, and yields a comparatively small proportion of its total flux between zero and 15° below the horizontal. In the enclosed arc lamp, on the other

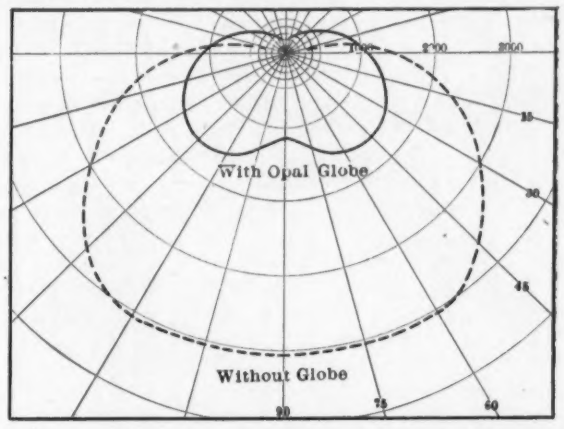


FIG. 2.—EXCELLO LAMP. DISTRIBUTION IN VERTICAL PLANE.

hand, the horizontal illumination is relatively very large, and at 15° below the horizontal the illumination is not far from the maximum.

Fig. 3 shows the result of tests made upon enclosed and open direct-current arc lamps, flaming arc and an alternating-current enclosed arc lamp. The voltage of the alternating-current arc was 70.7, the power factor being 0.85. The enclosed arc lamps were of the single globe type, the alternating-current arc being provided with a metallic shade. The globes were of opalescent glass, except for the open arc, which was bare. The flaming arc lamp was of slightly opalescent glass.

Taking the 6.5-amp., direct-current enclosed arc, it will be noted that from the horizontal down to about 12° below, the enclosed arc gives more illumination than the 9.5-amp open arc consuming the same power. This means that if the lamps were mounted on poles 25 ft. above the ground they would give equal illumination at a distance of about 115 ft. from the pole; beyond this distance the advantage would be in favor of the enclosed arc. Now taking the case of the flaming arc lamp consuming 360

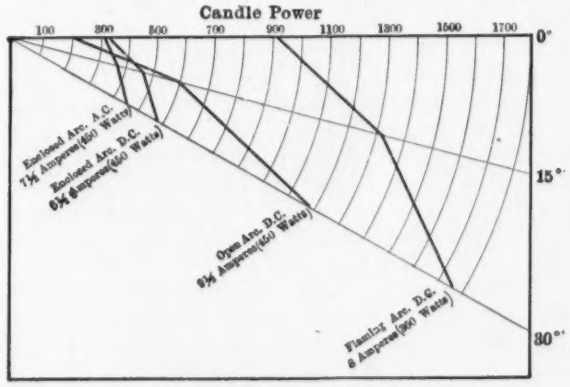


FIG. 3.—DISTRIBUTION OF ILLUMINATION.

watts, or four-fifths of the power of the enclosed arc, the illumination at a distance of 115 ft. from the pole will figure out 2.83 times that of the enclosed arc.

From the distribution of illumination, as shown in the chart, it will be seen that this same proportion holds approximately for all distances from the pole greater than 45 ft., at which point the light strikes the ground at an angle of 30° below the horizontal. At distances less than 45 ft. from the pole the proportion rapidly changes in favor of the flaming arc and reaches approximately 10 to 1 at a distance of 7 ft. from the pole. With

the 7.5-amp. alternating-current enclosed arc the amount of illumination distributed through the most effective zone for street illumination is considerably less than that of the direct-current enclosed arc with the same power consumption. The ratio of 2.83 to 1 cited above would, for the flaming arc and the alternating-current enclosed arc, be 3.3 to 1 at 12° below the horizontal, representing a distance of 115 ft. from the pole, 3.5 to 1 at 15° below, representing a distance of 95 ft. from the pole, and 3.9 to 1 at 30° below, representing a distance of 45 ft. from the pole. As in the last case, the proportion increases rapidly in favor of the flaming arc as the pole is approached. Hence, to obtain the most effective use of the remarkably high luminous efficiency of the flaming arc lamp, it must be provided with a reflecting device that will materially modify the distribution of illumination of the arc. There is reason to believe that considerable improvement in this respect may be brought about, but the problem is not a simple one. With the present distribution of illumination, the flaming arc lamp, if mounted on a pole having the same height as the poles now in use for street lighting, would produce an illumination in the immediate neighborhood of the pole entirely out of proportion to that given at a distance of 125 to 250 ft., which is about one-half the distance that now obtains between poles in arc lighting practice in this country.

To meet this difficulty it is apparent that unless the size of the unit can be materially decreased, the flaming arc lamp must be placed very high above the ground, so high in fact that in most cases serious questions arise as to the practicability of such a procedure.

The units now commonly employed are 8, 10 and 12 amp., with 45 to 50 volts at the arc. Owing to the special composition of the carbons and the peculiar nature of the arc, obstacles are encountered which make the practical operation of the lamp difficult when smaller currents are used. Moreover, in the small currents the luminous efficiency of the arc is very considerably reduced.

The concentration of the large amount of flux from the higher-current arcs in a single unit renders the lamp unsuitable for purposes of ordinary street illumination in the United States.

Central Station Notes from Grinnell, Iowa.

The history of the central station business at Grinnell, Iowa, like that in other towns, has been mainly one of costly mistakes up until a very recent time. The town itself, which has a population of 5,000, and stands second in the State in bank deposits per capita, is an excellent one for light and power business, because of the general prosperity of the farming community of which it is the center, and the fact that it has a high class of stores and residences for a town of its size and a fair average assortment of small power users. The electric lighting business was first started in Grinnell about 1886. Energy was obtained from the engine and boiler plant of a large harvester works. A 10-amp. series arc machine and a 75-volt, direct-current Thomson-Houston incandescent dynamo were the first machines installed. About two years later, after the alternating-current system came in, the electric light company purchased an abandoned barbed wire factory with its engine and boiler plant and changed its incandescent distribution system to alternating current. A high-speed vertical engine already in the barbed wire plant was belted to a line shaft from which both arc and incandescent dynamos were driven. The engine, which was too small to carry the load in the first place, soon proved to have other defects and another high-speed engine was added. The plant was a remarkable conglomeration of junk arranged about as badly as it could be for convenience and economy in operation. Later growth was provided for by adding high-speed engines direct-belted to dynamos, and an exhaust steam heating system for the business part of town was put in.

A great amount of trouble was experienced with boiler scale, no adequate provision being made for precipitating the scale-producing matter. The well water used contained over 60 grains of solid matter to the gallon, a large proportion of the solid matter being carbonates and sulphates of lime, which produce scale. Interruptions to service were frequent from various causes, the breakage of some of the numerous belts around the plant being the most prolific source of trouble. Belt centers were short and the oil-soaked belts had to be run very tight to carry the loads, which consequently caused abnormal wear and tear. Another periodical cause of shutdown was the overhauling of the boilers, which in a period of two years would get so encrusted with scale that flues had to be removed and scale taken off with coal chisels. As there were only two boilers in the plant and both were required to carry the peak load, there could not fail to be some interference with service whenever work on a boiler could not be done between sunrise and sunset. Like many other plants, it was owned and managed by men who had made marked success in other lines of business, but who knew little about the electric light business and had not the time to give it the attention it deserved. Later another Grinnell business man purchased an interest in the company and gave his entire time to the management with considerable resulting improvement in service.

A few years ago the original Grinnell Electric Light Company sold the plant to the Grinnell Electric & Heating Company. The new company secured a new franchise providing for a maximum rate of 10 cents per kw-hour. Arrangements were made for a general increase of plant capacity and the beginning of day service. The plant up to that time had not been operated during the day, although an exhaust steam heating plant had been installed which had to be supplied with live steam during the day, and there were a number of small power users about the town. The new company prepared to take care of power business by installing a separate 500-volt, direct-current service, retaining the old 133-cycle lighting distribution. The same inconvenient and costly-to-operate arrangement of boilers and machinery as before was retained and made worse by additions. The exhaust steam heating load was so large and the condition of the underground mains was so bad that the company was kept poor purchasing coal with which to keep the mains hot with live steam during the heating season, as the exhaust was entirely insufficient.

Up to this time it will be seen from this brief history that one engineering blunder had been piled upon another until the company had a large investment with little to show for it in the way of an economical plant or one which permitted of extension or enlargement without perpetuating undesirable conditions. During the past two years much has been done to improve both the service and the condition of the plant. In the fall of 1904 Mr. O. K. Cole took the management of the property under anything but encouraging circumstances. Cold weather was coming on and the condition of the heating mains was such that customers were up in arms against the company as a result of the service, or rather lack of service, from which they had suffered the previous winter.

First attention was given by the company to a prompt overhauling of the heating system, which was necessary to give service the coming winter. Upon digging up the mains a number of low pockets which prevented drainage were found. Consequently water traps would form and practically shut off steam service from certain customers. Customers' piping was in many cases found to be either inadequate or improperly installed and their installations consequently had to be given attention along with the outside service pipes. Along with this work Mr. Cole proceeded systematically to stop some of the numerous other leaks about the station itself. These were too numerous to enumerate in detail, but some examples may be given. A marine boiler which was one of the recent additions to the plant was provided with a motor-driven fan in the chimney to produce artificial draught. This fan was kept going at full speed all the time without regard to the necessities of the boiler, thus not only wasting power, but drawing a wasteful amount of air through the fire. Steam piping and fittings were frequently springing a leak and considerable fuel was being used simply to feed these leaks. No record was being kept of output or coal consumption.

Watt-hour meters were installed on the switchboard and as complete a set of records as possible was started. The next important move was the changing of the boiler plant. At the time the company secured its new franchise a contract was made to vacate part of the land then occupied by the plant in order that a new street might be cut through. The old battery of

boilers extended at right angles to the right-of-way of the Rock Island Railway. Coal was unloaded from a siding into a storage shed and from there had to be handled by team for a considerable distance. It was decided to move the entire battery of boilers around parallel with a new railroad siding which would provide for the new street being cut through between the station and the railroad. The boilers were so moved and incidentally the boiler plant was very much improved both in steam piping and general convenience. Coal is now unloaded into a storage shed running parallel to the whole length of the fire room. It is interesting to note that the cost of handling coal was 15 cents per ton before, as against 5 cents per ton now. As the plant is equipped entirely with simple high-speed engines it is, of course, impossible to secure very high economy, the present fuel and labor cost of current at the switchboard being in the neighborhood of 3 cents per kw-hour.

A very important financial leak that is being stopped is the abolition of flat rates, there having been a large number of flat rate customers who were costing the company more to carry than the amount of their bills.

The load has increased about 30 per cent during the past year. About 125 electric flatirons were introduced in a period of 18 months. The plan pursued has been to concentrate efforts in placing these irons at first where they will do the most good and be most talked about. A record of 125 irons in 18 months in a town of 5,000 is remarkable considering the fact that irons have not been distributed wholesale for free trial, as has been done in most other towns where the introduction has been rapid. There are also five complete electric cooking outfits in the town. A special rate of 4½ cents per kw-hour has been made on this heating and cooking business. Mr. Cole is somewhat undecided as to whether it will pay to push the heating and cooking business with so low a rate, as a large amount of this business would call also for a large investment and could not be considered in the same way as a non-peak load calling for no extra investment in generators, transformers, and meters. On this 4½-cent rate it is interesting to note that one family of seven does all its cooking, baking and ironing and operates a washing machine motor electrically for a bill of about $5 per month. Another family of two does its cooking and ironing for $2 per month. This family is equipped with two disc heaters, one coffee percolator, one boiler, one oven and one flatiron.

The total connected motor load is about 75 hp. There are 12 washing machine motors. The central station is now turning most of the wheels in town. There are seven electric signs on meters and four going in. The number of customers is about 400 and the number of 16-cp lamps or their equivalent connected approximately 10,000.

A logical system of rates is in vogue which does away with the inconsistency and dissatisfaction connected with some of the common discount systems in which discounts are made on the total quantity consumed. The Grinnell rate is 10 cents for the first 100 kw-hours, 9 cents for the second, 8 cents for the third, 7 cents for the fourth and 6 cents for the fifth, and all above that. In this way no discount is given until a bill is large enough to take care of the readiness-to-serve charges.

The company has not yet secured a contract for the pumping of the city water, although it could undoubtedly save the city considerable money by performing this service. That the company's offers have not been accepted is probably due mainly to distrust of the reliability of the service due to its deficiencies in the past, and which the present management must first live down.

The company is interested in a soft water supply system owned by a private water company. Soft water is obtained from a small artificial lake on the edge of town. The company gets all the soft water it needs for its boilers in return for furnishing power for pumping to the soft water company. Water is pumped by a 500-volt direct-current motor provided with an automatic starter. The pump is located about a mile from the central generating station.

The day will probably come when the whole system will be changed to 60 cycles, alternating current. All new work on the alternating-current lines is being accomplished with this change in view as the final result.

The Development of Central Station Business at St. Louis.

Among the notable work done in pushing for business by central station companies during the past year, that of the Union Electric Light & Power Company, of St. Louis, is worth attention. Business has increased 30 per cent in the last year, but Mr. W. V. N. Powelson, general manager, is not satisfied with what would be thought by many a remarkable showing, and is seeking a greater increase during the coming year. The following are some of the things that have been done at St. Louis that may interest other companies.

LIGHTING OF BILLBOARDS.

The company has laid a foundation for a good business in the illumination of signs and billboards at night. This is a class of

UCK PIANO CO.
OUR NAME A GUARANTEE FOR PIANOS WE SELL
OLIVE ST.
WE WILL WIRE AN 8 ROOM RESIDENCE COMPLETE WITH ELECTRIC FIXTURES FOR $35.00
ST. LOUIS HOUSE WIRING and FIXTURE CO.
OUR SPECIALTIES WIRING RESIDENCES

FIG. I.—ST. LOUIS ILLUMINATED BILLBOARD.

business which has not been given much attention by central station companies. In St. Louis it was at first opposed by the billboard and bill posting companies on the theory that if a customer had only a certain amount to spend in advertising, the billboard company would be likely to get less if a part of the money were spent in illuminating the billboards at night. The principal bill posting company doing business in St. Louis has, however, been converted to a broader view and brought to realize that the illumination of billboards at night is a stimulant to the advertising business, so that it is the gainer rather than the loser by this innovation. This billboard lighting is taken at a flat rate of so much per month, the contract reading that the lamps are to be used only from 6 p.m. to midnight. This keeps the billboard lamps off the December peak, which occurs about 5.30 p.m. The billboard lamps are turned on and off and maintained by the company. A trough metal reflector is used for this lighting, as shown in Figs. 1 and 2. This reflector is painted white inside. The company will make no contract for less than one 16-cp lamp per 18 in. linear length of board, as that much is required to produce a good effect. The company at present writing sells illumination for about 1,800 linear ft. of billboard and has in addition about 1,200 linear ft., which it uses for advertising its own business. From this it will be seen that billboard advertising is made extensive use of in the St. Louis new business campaign. Figs. 2 and 3 show a billboard advertising the M., K. & T. Railway, this board being over a hundred feet long. Fig. 4 shows a striking billboard advertisement which illustrates the general policy of the company, which is to encourage the public to make their grievances known if they have any.

RESIDENCE WIRING.

In Fig. 1 is seen a billboard advertisement of the St. Louis House Wiring & Fixture Company, which illustrates one feature of the campaign that is being carried on to secure the thousands of unwired residences in St. Louis as customers. This offer to wire an 8-room residence complete with fixtures for $35 is made by the St. Louis House Wiring & Fixture Company. While this course does not apply to a very elaborate job of house wir-

ing, nevertheless it gets people interested, which is the main thing. The $35 proposition spoken of is for moulding work and certain plain standard fixtures which have been made up in large quantities. These fixtures, which were illustrated in the March 15, 1906, bulletin of the company, consist of one three-light chandelier, costing the customer complete $3.50; two two-light chandeliers, costing $2.75 and $2.45; one pendant costing $1.08; three brackets costing 90 cents and one costing $1.50. The total comes to $13.98.

It is estimated that there are in round figures 30,000 houses without electric service of any kind in St. Louis, and that 20,000 are not even wired. In November, 1905, the company in one of its bulletins made the following offer:

FREE

TO THE FIRST TWO HUNDRED WHO APPLY

We will inspect your residence wiring to see if it is in good condition—FREE.

If in good condition, we will make connection to the house and install service—FREE.

We will lend you for sixty days what incandescent lamps you require—FREE.

If, at the end of sixty days' trial, you are not satisfied with the service, we will disconnect our lines—FREE.

For the sixty days' trial you pay only for the current you use at our standard rates.

For Form of Application, See Below.

NOTICE PARTICULARLY—That we are developing a line of electric light fixtures, which may be purchased of or through us at *prices* and *terms* within easy financial reach of all. Be sure to see or write us about this. See p. 10, and read carefully.

This offer was, of course, intended to secure some of the numerous residences which were wired but were not taking elec-

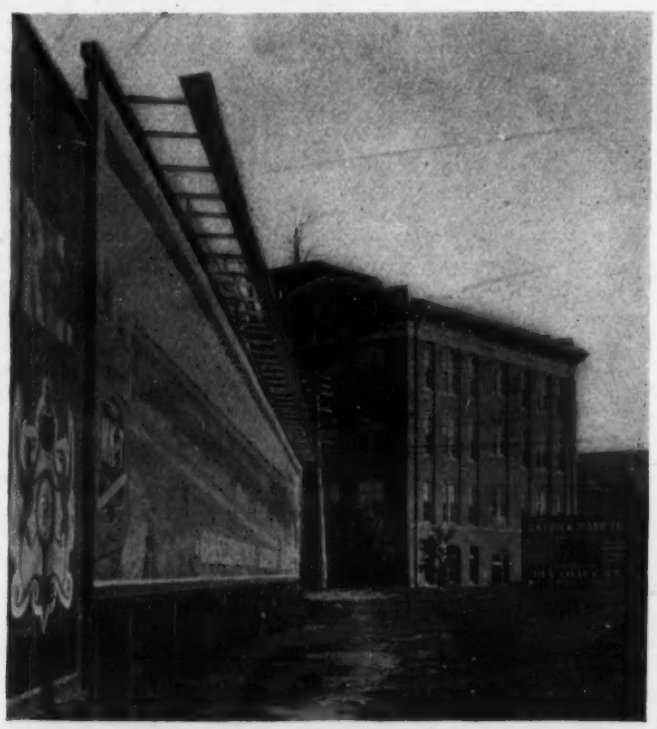


FIG. 2.—METHOD OF LIGHTING ST. LOUIS BILLBOARDS.

tric service. The company in making this announcement stated that it had already reduced the price of electricity from the former average price of 20 cents per kw-hour for residences to a maximum rate of 12 cents per kw-hour, with discounts for prompt payment, and for long hours of use. This reduction in price, the company went on to state, was made voluntarily on the theory that a small margin of profit from many customers makes a more stable business enterprise than a large margin from a few customers. Moreover, pole lines were built, capital was invested and the depreciation and repairs due to weather and other conditions were going on regardless of whether customers were connected to the lines or not. Having cut the price of electricity it became necessary to put many more customers on the lines. The reduction in price of electricity, coupled with the great improvement in the quality of incandescent lamps and the

FIG. 3.—100-FT. ILLUMINATED BILLBOARD AT ST. LOUIS.

many inventions during the past two years of electrical appliances that have become household necessities, had brought about a new era under which no one would be willing to do without electric service in his home if he but knew the cheapness, comfort and convenience of it. It was then explained that the company had such confidence in the cheapness, healthfulness, comfort and convenience of electric service that it was willing to take all the risk of making a service connection free on a 60-day trial offer. It was further explained that inasmuch as the cost to run wires to a residence, install a meter, supply lamps and if unsatisfactory to disconnect, and remove the meter and lamps would average about $20 per residence, the company was in effect putting up a forfeit of $20 per customer which it would lose if what it had claimed about the advantages of electricity in the home did not prove true. Many more than 200 applied and were connected, and in the February 1 bulletin this offer was extended.

Up to May 23 the result of this effort was as follows:

Total number of applications	600
Cancelled on account of needing line extensions or on account of cost of changes in wiring necessary	150
Cancelled account of poor credit	40
Still pending and under investigation	75
Net, connected	335

The number of residence customers on the company's lines is about 9,000; the number of down-town customers, 3,400. According to the figures previously given, there are about 10,000 wired-and-not-connected houses in the city. In the company's March bulletin a list of 60-day trial customers, giving the names, addresses, date connected, number of days current was used and amount paid per month was published. On this list only 6 had been disconnected and those because of removal and not because of any fault found with the service.

ELECTRICITY AND HEALTH.

The March bulletin of the company took up in a very thorough and convincing way the question of electricity and health in the home. First there was given the percentage of deaths from certain causes in the United States in 1890 and 1900, as shown by the Twelfth Census. This chart showed that the deaths from consumption and pneumonia, which are primarily bad air diseases, were far in advance of the deaths from any other diseases. The deaths from contagious diseases for St. Louis for the past week were also given, showing consumption to have taken 24, while typhoid fever, the next highest, only took 5. Then were given some extracts from a recent paper by Prof. Irving Fisher, of

Yale University, on the "Modern Crusade Against Consumption" The paragraphs of most interest in this paper are as follows:

"Who are the invalids who fill the health resorts of Colorado and California? Invariably the victims of indoor life, of food bolting, of overwork and of worry. I have often wondered what would happen to the human race if it should suddenly adopt sleeping out of doors, ventilating dwellings, schools and factories, taking proper time for meals, learning the art of relaxing and the habit of equanimity. It is certain that life would be longer and also fuller. Before any great progress can be

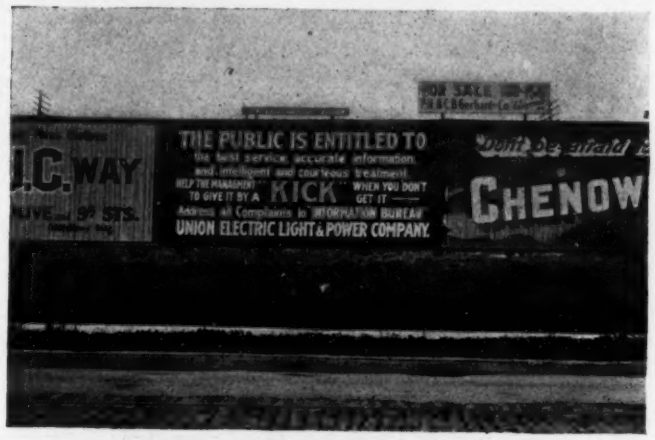


FIG. 4.—A STRIKING BILLBOARD AD.

made, however, our change of habits must be radical, however gradually adopted. We must open our bedroom windows wider and at the tops rather than at the bottoms. We must substitute electric lamps for oil and gas, one jet of which is equivalent to three or four persons in its power to vitiate the air. We must learn anew what pure air is and insist in having it, not only at home, but in our offices, our clubs, theatres, churches and sleeping cars, and above all, in our factories and our schools."

SOLICITATION.

A force of 34 solicitors is maintained. The city is divided among four chief solicitors, each chief having under him a number of district solicitors. The four chief solicitors are held responsible for the work in their respective districts. Solicitors are paid $40 per month to start, which is afterwards raised to $50, and are given a commission based on the business secured. The chief solicitors get a commission on the salaries of the solicitors under them, when a solicitor's salary exceeds $80 per month. This, of course, is an inducement to the chief solicitors to keep only good men under them.

FLATIRON CAMPAIGN.

The introduction of electric flatirons was begun the latter part of February, 1906. These irons were put out on 30 days' trial. Orders for trial irons and also for turn-down lamps were taken by a corps of young ladies calling at each house. On May 24 the results of this effort could be summed up as follows:

Application for irons on trial	706
Delivered	514
Returned and cancelled	192
Under investigation or still pending	126
Delivered and charged	388

A 6-lb. iron is sold for $6. Payment will be taken in installments of $2 per month.

ADVERTISING LITERATURE.

The company issues bulletins of magazine size at irregular intervals. Each bulletin is devoted to some one subject. For example, the February first bulletin is entitled, "Incandescent Lighting" and deals especially with the new high-efficiency carbon filament lamp and the improvement in electric lighting made possible by it. The decrease in cost of lighting with the new lamp is well brought out and attractive illustrations of the new lighting unit with a picture of Thomas A. Edison on the bulb are given. Altogether, it is well calculated to convince a possible customer that an important improvement in electric lighting has been perfected that will enable him to get more for his money than ever before.

The March 15 bulletin is entitled, "Electric Lighting, the Foe of Tuberculosis," and deals, as noted above, especially with the hygienic value of electric light in the home and gives a large amount of information as to the cost of wiring and the cost of operation of electrical appliances. The following list of appliances and their costs is given:

Article.	Price.	Maximum Limit of Cost to Operate.
Electric Fan (moderate speed)	$10.00	½ cent per hour.
" Fan (full speed)	10.00	⅔ cent "
" Smoothing iron	6.00	3½ cents "
" Warming pad	6.50	⅔ cent "
" Curling iron heater	3.75	⅔ cent "
" Chafing dish	17.50	5 cents "
" Stove, 6 inch diameter	6.50	4¾ cents "
" Immersion coil	9.00	⅔ cent to boiling point.
" Water heater, 1 pint	6.50	⅔ cent " "
" Tea kettle	10.00	1½ cents " "
" Coffee percolator	15.00	1½ cents " "
" Broiler	15.00	4¾ cents, steak ready to serve.

All the various offers of the company, as the free 60-day trial, service connections, etc., are given on the back cover.

The bulletin dated May 1 is entitled "Electric Power" and deals altogether with matters of interest to isolated plant owners and power users. In this bulletin the accompanying blank (Fig. 5) entitled "Monthly Power Account—Ledger Insert," is given. These blanks serve as a useful reminder to the owner of the isolated plant to include in his power account numerous items frequently forgotten. These blanks are made up in tablets

MONTHLY
POWER ACCOUNT—LEDGER INSERT.
ITEMS CHARGEABLE TO ISOLATED PLANTS.

	OPERATING EXPENSES.			
1	Superintendence,			
2	Wages, Engineers and Engine Attendance,			
3	Wages, Firemen and Coal Passers,			
4	Fuel,			
5	Cost of Removing Ashes,			
6	Water for Boiler,			
7	Repairs to Engines,			
8	Repairs to Boilers,			
9	Repairs to Dynamos,			
10	Repairs to Belts,			
11	Repairs to Steam Elevators,			
12	Repairs to Hydraulic Elevators,			
13	Repairs to Pumps and Miscellaneous Machinery,			
14	Incandescent Lamp Renewals,			
15	Arc Lamp Carbons,			
16	Arc Lamp Globes,			
17	Arc Lamp Repairs,			
18	Miscellaneous Expense, Oil, Waste, Packing, Etc.,			
19	Insurance—Fire and Boiler,			
	TOTAL OPERATING EXPENSES,			
	FIXED CHARGES.			
20	Interest on Plant Investment, 5%,			
21	Depreciation on Plant Investment, 7%,			
22	Rental Value of Space Occupied by Plant,			
23	Decreased Rental Value of Space Made Less Desirable by Heat of Plant in Summer,			
24	Taxes on Plant,			
25	Risk of Damage to Employes and Public through Accident,			
	TOTAL FIXED CHARGES,			
	COST FOR MAINTAINING PLANT, PER MONTH,			

By permitting us to serve you, you will bunch all these items into
ONE POWER BILL.

FIG. 5.—EXAMPLE OF POWER BLANK.

and sent to isolated plant owners. Of course, most of them are used for scratch paper, but some of them set the recipients to thinking in the course of time, and as soon as they begin to use the blanks to figure their operating expenses and fixed charges, it is likely to be an easy matter for the central station company to close a contract which will shut down the isolated plant.

AUTOMOBILE CHARGING STATION.

An electric garage has been started at 2935 Olive Street, as the company has become convinced that the way to encourage the

electric automobile business in the city is to open a place where vehicles can be properly looked after. The rates for keeping vehicles at this garage are as follows:

Vehicles of 3,000 lbs. weight and under	$30.00 per month
Vehicles of 3,000 lbs. weight to 6,000 lbs. weight.....	37.50 per month
Vehicles of 6,000 lbs. weight to 10,000 lbs. weight.....	45.00 per month

These figures include all attention to batteries, cleaning, etc., but of course do not include battery renewals. For the delivery and return of the vehicle an extra charge of $5 per month is made. Such delivery and return is always made at the owner's risk. This garage is the St. Louis depot for the Exide battery and a stock of batteries and parts is kept there.

CLEVER ADVERTISING.

Attention has already been called in Fig. 4 to one of the company's best billboard advertisements which catches the attention of the hasty reader with the announcement, "The Public is Entitled to Kick." Another telling advertisement is that on an illuminated billboard near the Union depot. It is placed side by side with another illuminated sign and reads, "We Lighted Our Sign—This Man Had To." A large hand points to the adjoining sign, which is also lighted.

Western Enterprise With Flat Irons.

The Washington Water Power Company, of Spokane, Wash., has been meeting with remarkable success in the introduction of electric flatirons through one of the daily newspapers of that city. The Spokane *Evening Chronicle* offers an electric flatiron as a premium in connection with a subscription to that paper. All old and new subscribers agreeing to take the newspaper for 65 weeks at the regular rate of 10 cents a week for the paper and 5 cents a week additional for the iron, can secure irons by calling at the *Chronicle* premium department. The Washington Water Power Company furnishes the irons to the newspaper at $3 each. The *Chronicle* is selling them at the rate of 50 per day, having at present writing sold over 2,000, and if the irons could have been secured, many more could have been sold. The iron is of the 6-lb. household type. A recent issue of the *Chronicle* comes out with a full-page advertisement of this premium offer, in the center of which is a large picture showing the modern way of ironing, and flanked by the following:

Saves Your Complexion.	Uniform Temperature.
Saves Your Temper.	No Scorching.
Saves Your Clothes.	No Dirt.
Saves Your Health.	Is Never Too Cold.
Saves Your Money.	Is Never Too Hot.
Saves Your Time.	Is Always Ready.
	Needs No Reheating.

The placing of over 2,000 irons in a city of 100,000 inhabitants within a period of 7 months well illustrates the progressiveness of far Western people as well as the efficacy of this method of introducing irons. The plan will doubtless work well in many other cities. An aid to its rapid introduction is the low rate for electricity in Spokane.

Electricity in the Hotel.

Denver is now ambitious to be as well known as the "Electric City," as it is as the "City of Lights." There is no municipality in the country increasing its use of electric current with more rapidity than this city. The new "Albany" is electric practically from top to bottom and the "Shirley" Hotel, which is operated in connection with the Shirley Annex, recently gave up its own electric plant in order to give wider scope to its electric service. It is now using current furnished by the Denver Gas & Electric Company.

The Shirley is attracting the attention of visitors by the splendor of its electric lighting and by the many electric conveniences which it provides. The sign at the entrance is a model of its kind. It is quiet in design, but strikingly effective. The arrangement of lamps in the lobby is a distinct achievement in securing the best possible effects. The same may be said of the lighting in the hallways and in every room in the house.

The permanent guests of the house enjoy every modern electric convenience—a feature so widely discussed that every other hotel in the city must sooner or later follow in the same footsteps if it would satisfy the popular demand for electric appliances necessary for the comfort of hotel guests. One will find an electric chafing dish in nearly every room of the Annex. The massage vibrator is another appliance that has come into great popularity with the women guests, who also can heat their curling irons with electric heaters. The electric iron is not uncommon in many of the rooms. In truth there is every appliance necessary for the most fastidious.

Letters to the Editors.

Motor-Generator Fly-Wheels.

To the Editors of Electrical World:

Sirs:—I have noted the letter in your issue of June 30 from Mr. Rudolph Braun, of Manchester, England, relative to the "Ward Leonard System in a German Colliery," which was published in your issue of March 3.

I judge from Mr. Braun's letter that it was the successful operation of the moving platform at the Paris Exposition by the Ward Leonard system, which led Mr. Braun (and later Mr. Ilgner) to suggest the employment of this system for large hoists, reversing rolls for rolling mills, etc. But Mr. Braun seems to think that the method of automatic regulation of the speed and torque so as to automatically control the power consumption, was invented by someone other than myself, for he says:

"The essential difference between the Ward Leonard motor-generator and the Ilgner system is in the automatic slip regulator, which in the case of a direct-current motor serves as an automatic field regulator. The slip regulator may be operated either by a centrifugal regulator or by a current relay connected into the mains from the power station, and tending to keep the current consumption of the motor-generator constant. Without this slip regulator the motor-generator with the fly-wheel would be of very little use, and I think it is this apparatus in connection with the Ward Leonard motor-generator which is the essential characteristic of the Ilgner system."

If the Ilgner system has for its foundation the invention of the described method of automatic control of the power consumption, I wish to state as a matter of record that I reduced to successful practice the invention of this method of motor control in 1891, and that the undisputed proofs of such successful reduction to practice of this invention constitute a part of the court records in the case in which I was recently upheld as the first inventor of the multiple-voltage system (U. S. patent 478,344, dated July 5, 1892).

This method of automatically controlling the torque and power consumption for duties such as hoists, where variable speeds are required by practice, is patented to me by United States patent No. 717,584, which was applied for February 6, 1897.

I have numerous patent applications pending, filed long prior to the moving platform installation, which cover various modifications of the broad idea of automatic and economical control of the power at variable speeds, variable torques, automatic reversing, etc., and thus far my claims as the original inventor thereof have been allowed by the Patent Office without interference with Mr. Ilgner, or any other alleged inventor. Therefore, I am still unable to see that the so-called "Ilgner" system is anything more than a European commercial use of the Ward Leonard system, as described in my United States patents filed many years before the first date thus far set up for the so-called "Ilgner" system.

I personally spent several days with the leading engineers of Siemens & Halske in Berlin, in April, 1900, and explained the various forms of my method of control to them in detail in an endeavor to interest that concern in its commercial introduction. According to Mr. Braun, the first publication as to the so-called "Ilgner" system by Siemens & Halske was in November, 1902.

My reason for recording these facts is merely that my silence might be misinterpreted. Whether it is really the Ward Leonard system or the Ilgner system is unimportant to the public. The system works just as well under either name. The important fact is that the recent rapid introduction of this system in Europe for large hotels, rolling mills, etc., seems to indicate that it is likely to replace all former methods of operation, and that the inventions have opened up a field for the electric motor, second in importance only to that of electric traction.

When this system is introduced commercially for large hoists, rolling mills, etc., in this country, the question of whose system it is will not remain long in question, as my patents will be promptly acqnowledged or passed upon by the courts.

BRONXVILLE, N. Y. H. WARD LEONARD.

American vs. Foreign Incandescent Lamps.

To the Editors of the Electrical World:

SIRS:—In your issue of July 14 you editorially comment on the European central station practice as follows:

"Each consumer buys his lamps across the nearest bargain counter and every one is happy. The difference is that the high efficiency lamps are but little understood in Europe, and consumers, therefore, consume electrical energy with a healthy appetite. Central station companies freed from lamps and lamp renewals and aided by saving in copper (250 volt versus 125 volt systems), can make both ends meet on a lower price for electric energy and thus the cost of a candle hour with low efficiency lamps and a low cost per kw-hour is quite reasonable; so that our European neighbor does not need our pity."

This statement in the main does not correspond to conditions of European lighting stations as they have been reported in other accounts. It is very questionable if the consumer is happy in buying his own lamps, as the results he obtains are certainly not happy ones. This is evidenced by the testimony of English central station engineers, for example Mr. Geo. Wilkinson in a paper read before the Leeds Local Section of the English Institute of Electrical Engineers last February, states:

"It is when we get beyond the meter that waste and extravagance take place. This is due to incorrectly rated, inefficient lamps, and the persisted use of old blackened lamps. So marked is this lamentable waste, and its effect on the future of electric lighting is so serious that it is high time some concerted action was taken by the supply authorities throughout England to deal effectually with the matter.

"Electrical engineers have too long considered themselves simply producers and purveyors of electrical energy and have not concerned themselves with the problem of turning a minimum amount of electrical energy into a maximum amount of lighting power, the consequence being that many a user is paying for double amount of electrical energy he ought to pay, and not a few consumers have gone back to the use of gas.

"To show the urgent need of attention of engineers to the points raised, the following cases have come under my personal notice in the last few months.

"In one big building 80 32-cp British made lamps took 170 watts each, or 5⅓ watts per candle.

"In a private house 8 cp British made lamps in use gave in one case only 2 cp at 11 watts per candle, and in another 3 cp at 8 watts per candle.

"In a private house the consumer was found to be using 2½ cp lamps taking 30 watts each, or 12 watts per candle.

"In a big building in a large city in Scotland, British made lamps were found to be taking 8.3 watts per candle, and 9 watts per candle on some continental made lamps.

"Investigation in Yorkshire showed an average of 7.6 watts per candle on foreign lamps used, and 7 watts per candle on British made lamps.

"Investigation in the different cities of Lancashire on new 16-cp lamps showed a variation of 3¼ to 8 watts per candle with a variation in candle power at voltage of from 10¼ to 20 candles."

From this showing you can see that the British consumer actually uses and pays for at least twice as much energy per candle power of illumination as the American consumer.

Your statement regarding the saving to central station company on lamp renewals and investment in copper enabling station to make a lower price for electrical energy and thus offset the effect of the lower efficiency lamps, is a mistaken one. As far as lamp renewals are concerned, the cost per kw per hour on English types of lamps, including 8-cp, does not amount to over 0.4c., if that much, and the saving on the investment in copper is probably not much more than a similar amount, so that we have a total of about ¾c. per kw-hour having for the English central station on these items to enable them to reduce rates and offset, as you suggest, the effect of low efficiency lamps used.

To maintain that this difference even if fully given to the consumer would by any means offset the inefficiency of his lamps, is very much of a mistake. In comparison with the service which American consumers obtain from the use of high-efficiency lamps supplied under free renewal systems, the English consumer, contrary to your statement, is most assuredly to be pitied. He has reaped little, if any, direct benefit from the employment of 250-volt systems as compared with the 125-volt systems in general use in this country. The adoption of these systems seems to have been solely in the interest of the central station.

Harrison, N. J. F. W. WILLCOX.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Repulsion Motor.—CREEDY.—A mathematical paper giving in detail the calculation of an Atkinson single-phase repulsion motor.—*L'Eclairage Elec.*, July 14.

Lamps and Lighting.

Differential Arc Lamps.—FOULHOUZE AND GUEDENEY.—The conclusion of their paper on direct-current differential arc lamps and their usual methods of connections.—*L'Eclairage Elec.*, July 14.

Power.

Locomobiles.—HEILMANN. An abstract of a paper read before the Hamburg Electrical Society on modern locomobiles and their use in electric generating stations. Locomobiles are especially valuable on account of their low consumption of fuel. The Wolf "hot-steam locomobiles" are of very simple construction and great reliability; tests by Prof. E. Josse, in Charlottenburg, show that a 50-hp locomobile consumes 4.67 kg of steam and 0.567 kg of coal per effective hp-hour. Other advantages are small space, simple method of erecting, etc. To judge its economy it is, however, necessary to give the total cost of operation. On the basis of 3,000 hours of operation per year, the total cost of a 10-hp Wolf hot-steam locomobile is 1⅞ cent at ⅔ load and 1½ cent at full load per effective hp-hour. For a 200-hp locomobile the total cost is reduced to ¾ and ⅝ cents, respectively, per effective hp-hour. For comparison it is stated that the total cost of the hp-hour in a suction gas engine plant of 10 hp is 2¼ cents at ⅔ load and 1⅛ cents at full load, while for a 200-hp plant the figures are 1⅛ and 13/16 cents, respectively. It is stated that out of 10,000 locomobiles for normal capacities up to 400 hp, 830 are used in electric generating stations.—*Elek. Zeit.*, July 12.

Italy.—BUDAU.—An illustrated lecture on hydroelectric stations in upper Italy.—*Elek. und Masch.*, July 15.

Traction.

Earth Currents from Tramways.—An account of the report of the Commission of the German Gas and Water Companies for

the investigation of earth currents from tramways and the resulting destruction of water and gas pipes. The experiences of several cities are given, but no general conclusions are drawn. —Lond. *Elec.*, July 20; a very full account of the researches so far made in *Jour. f. Gasbelecht*, July 21.

Electropneumatic System.—The first part of a discussion of the electropneumatic operation of switches and signals.—*Elek. und. Masch.*, July 15.

Installations, Systems and Appliances.

Converters.—Weiss.—A paper read before the Cologne Electrical Society discussing first the relative advantages of synchronous motor generators and induction motor generators. The author favors the latter one, although they are used very little in Germany, probably for fear of the wattless currents. The author then begins to discuss rotary converters.—*Elek. Anz.*, July 15.

Isolated Plant.—Bates.—A general discussion of isolated plant engineering.—*School of Mines Quarterly*, April.

Wires, Wiring and Conduits.

Wooden Poles.—Wooden poles inserted in earth usually rot first at the point where they are in contact with the surface of the ground. To protect them it is recommended to point the pole with tar up to 50 or 60 cm above the ground and down to about 40 cm below the ground. The painted part of the pole is then covered with a cloth which is fastened to the wood with small nails and also painted with tar. A metal sheet, for instance a zinc-plated iron sheet, is placed around the cloth and is tightened to the pole. It is also painted with tar on both sides.—*Schweiz. Elek. Zeit.*, June 9.

Electrophysics and Magnetism.

Self-Induction in an Iron Cylinder.—Wilson.—If a solid cylindrical conductor be divided into imaginary concentric tubular conductors, the ordinary self-and-mutual-induction theory shows that when the conductor is subjected to an alternating e.m.f. the interior shells carry electric currents of smaller density than the exterior ones, and the currents suffer a phase displacement greater the nearer the centre of the cylinder. When, however, the material of the conductor has variable permeability the problem becomes more complicated and the author has studied experimentally what goes on in an iron cylinder when electric currents are reversed in it, and maintained steady after reversal. The cylinder employed was of mild steel and has a diameter and length each equal to 10 in. It was provided with holes drilled in a plane containing its axis of figure in such a manner that exploring coils could be threaded to enclose certain portions of that plane. The exploring coils were three in number, each 2 in. wide in a direction parallel with the axis of the figure and midway between the ends of the cylinder; their depths in a radial direction being 1, 2 and 2 in. and their average radii 0.5.2 and 4 in. respectively. These coils are referred to as coils Nos. 1, 2 and 3, No. 1 being near the centre of the cylinder. The results of the experiments are given in three interesting diagrams with the time after reversal as abscissae and the volts per turn per sq. centimeter as ordinates. All the curves of the diagram of coil 3 show a strong maximum immediately after reversal and only one of these curves shows a slight indication of a second maximum later on. Two maxima, the second of greater amplitude than the first, are clearly shown in the diagram of coil 2 and still more clearly in that of coil 1.—Lond. *Elec.*, July 20.

Electric Discharges. An account of some recent investigations on electric discharges. Schwedoff has studied the relation between potential and spark length in a sensibly uniform field as between large plane surfaces or large spheres. Algermissen has studied the potential and spark length curves with small spheres and large gaps and has also determined the sparking potentials for very high frequencies of the order of a million per second, obtained from a condenser fed with an induction coil. With frequencies well above a million reversals per second the curve becomes a straight line except for extremely small gaps, but this straight line does not pass through the origin. Hence the relation between the minimum potential difference P and the gap length F may be represented by $P = a + bF$ where a and b are constants depending upon the frequency and the radius of the spheres. While with static charges the curves for the various sizes of spheres are very different, the difference is less at high frequencies. Koch has studied continuous condenser discharges and concludes that the apparent spark resistance is very large in the case of continuous discharges through high resistances, and is of quite a different order of magnitude from the resistance of oscillating discharges through small resistances.—Lond. *Elec.*, July 20.

Reflection of Cathode Rays.—William.—An account of an experimental investigation of the reflection of cathode rays from thin metallic films. This does not all take place at the surface of the metal, but there is penetration and then reflection for a large part of the reflected rays. From a critical potential on, a thin metallic film of aluminium reflects less than a thick one, since a part of the rays have been lost by transmission. This decrease in the amount reflected from a thin film appears first in the most deflected rays and with increasing potential will also be found in the least deflected portion. The critical potential depends on the thickness and the nature of the film.—*Phys. Rev.*, July.

Roentgen Rays.—Bordier.—A summary of the different qualitative and quantitative methods now available for the measurement of Roentgen rays and of rays from radioactive bodies.—Lond. *Elec.*, July 20.

Luminescence.—Nichols and Merritt.—A paper describing further experiments on the decay of phosphorescence in Sidot blende and certain other substances.—*Phys. Rev.*, July.

Electrochemistry and Batteries.

Development of Chemistry.—Ostwald.—The third and fourth of his course of six lectures held at Columbia University on the historical development of general chemistry. The subjects dealt with are the molecular theory, including osmotic pressure, and constitution and isomerism (organic chemistry).—*School of Mines Quarterly*, April.

Electric Vacuum Furnace.—Arsem.—A fully illustrated description of his electric vacuum furnace, the attainable temperature in which is limited only by the vaporization of carbon. The construction of the furnace was described by the author in a paper read at the Ithaca meeting of the American Electrochemical Society.—*Journal Am. Chem. Society*, August.

Electric Smelting of Iron Ores.—Haanel.—A full account of the experiments recently made with the Heroult furnace at Sault Ste. Marie.—*Jour. Am. Chem. Soc'y*, August.

Fixation of Atmospheric Nitrogen.—Birkeland and Guye.—Two valuable papers on the fixation of atmospheric nitrogen. Birkeland deals especially with his own process, which is in use in Norway, while Guye discusses the whole problem, with special reference to the physical chemistry of the subject.—Lond. *Elec.*, July 13, 20.

Electrogalvanizing.—An illustrated note on a Cowper-Coles electrozincing plant in a British iron and ship building works.—Lond. *Elec.*, July 20.

Units, Measurements and Instruments.

Errors in Photometry.—Wild.—An article pointing out that few photometrists properly appreciate the importance in photometry of the elimination of angularity errors. There does not exist in practice anything like a perfect screen, that is—one which appears equally illuminated at no matter what angle it is viewed, the illumination being also exactly proportional to the cosine of the angle from the perpendicular at which the light rays strike its surface. The author discusses the variation of illumination with the angle of view, the errors due to side play of carriage and the errors due to incorrect alignment of lamps. He arrives at the following general principles for the avoidance of angularity errors. The two surfaces to be viewed must be absolutely parallel, so that side play between carriage and bar may affect the illumination of both surfaces in the same direction and to the same degree. Both surfaces must be normally perpendicular to the light rays falling upon them, so that should either light be out of true alignment, the effect upon the illumination shall be negligible. The surfaces must be viewed through a tube, so that the angle of view cannot become changed to any appreciable extent. A telescope answers the purpose very well. On the basis

of these principles the author has developed a flicker photometer which is quite free from angularity errors. He uses a special form of Bunsen disc revolved by an electric motor and viewed by the agency of a mirror and telescope. Fig. 1. shows the disc, which is cut out of ordinary white blotting paper and has about half of its surface treated with white paraffin wax, so that half the disc is opaque and reflecting and the other half translucent and diffusing. The disc is revolved on its centre by means of a small 2-volt motor. A small portion of the upper part of the disc is viewed through a mirror and telescope. The arrangement of mirror and telescope is shown in Fig. 2. The object of using a telescope instead of a simple lens is that if no diaphram is used

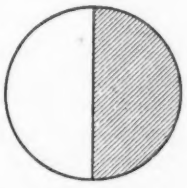


FIG. 1.—DISC.

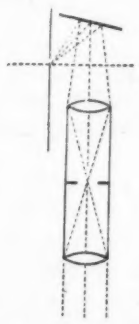


FIG. 2.—ARRANGEMENT OF MIRROR AND TELESCOPE.

the eye finds it very difficult to keep in focus on the disc, which, when revolving, shows no detail. As arranged, an image of a portion of the revolving disc is formed, in the air so to speak, inside the diaphragm. The eye-piece is adjusted till the diaphragm appears in focus and thus the eye is automatically focussed upon the revolving disc. Keeping the disc in absolute focus increases the sensitiveness of the photometer and at the same time very greatly reduces the fatigue to the eye.—Lond. *Elec.*, July 20.

Photometry of the Mercury Arc.—LAPORTE.—A communication concerning some curious phenomena of "hetero-chromatic photometry" presented by the measurement of candle-power of mercury arcs in comparison with ordinary incandescent lamps. In one experiment, the tube of the lamp having been placed at right angles to the axis of the bench was at the moment of balance at a distance of 186 metres from the photometric screen. The apparatus employed was of the "Lummer-Brodhun contrast" type, and the standard was an incandescent electric lamp of a well-known make. The calculation of candle-power gave 14 candles. But when the mercury lamp was placed at a distance of 21.50 metres from the screen of the photometer the measurement was 25 candles. In the Central Laboratory of Electricity in Paris where these experiments were made these apparently abnormal results were considered to be a consequence of the well-known Purkinje phenomena. The writer shows why two other possible causes which had been suggested by Bastian could not have contributed considerable to this effect. The following experiment, which was made at the time of the tests, shows that the physiological phenomenon of the eye known under the name of Purkinje is capable of causing abnormal results in such measurements. In making photometric measurements with short distances it had been noticed that symmetrically different results were obtained for the equilibrium position of the photometer according to whether the eyepiece of the apparatus was observed with the eye normally open, or, on the other hand, with the eyelid lowered, so that the luminous field of the photometer was observed with the eye almost closed. A disc of cardboard pierced with a small pin hole was therefore placed in front of the eyepiece of the photometer and measurements were made with this cardboard in place as a diaphragm. With a distance of 1.9 metres between the lamp and the photometer screen, measurements were obtained giving a candle-power of 17 candles, or even 22 candles, according to the dimensions of the diaphragm. It seems, therefore, that these variations depend upon the physiological sensibility of the eye, which differs according to the color and quantity of the light received by the retina. With the smallest diaphragm the sensation of the difference of color is very small, but the sensibility of the eye for measurement is much diminished.—Lond. *Elec.*, July 20.

Amperehour Meter.—BECKMANN.—A discussion of direct-current amp.-hour meters with revolving armature. Their use has extended greatly in recent years, probably on account of their low price. With respect to reliabity, especially at low load, they are inferior to the much more expensive watt-hour meters while they have that one great advantage over the latter that they will not run at no load. An amp.-hour meter consists of a direct-current armature free from iron and revolving in the field of a permanent magnet when an e.m.f. is supplied at the brushes on the commutator. If this e.m.f. is taken off from the terminals of a small resistance through which the current to be measured flows, the armature speed will be proportional to the current and the readings of the meter will be proportional to the coulombs. In addition to differences in details of construction, meters of this kind built by different companies differ especially with respect to the larger or smaller damping effect of the armature rotation, the damping effect being always obtained by eddy currents. The mechanical construction of the armature requires a metallic frame in the form of a disc or cylinder as support of the armature winding. The armature core therefore becomes the seat of eddy currents which cannot be avoided. The chief difference in the design of different companies may be found in that some designers try to increase as much as possible this eddy-current damping effect while others endeavor to suppress it as much as possible. This gives two different types of meters which behave in a very different way when in the course of time the "constants" of the meter (armature resistance, transition resistance at the brushes, magnetic field, friction, etc.) change. The author gives the mathematical theory of the effect of such changes and gives figures as to the amounts of these changes for two different types of meters. One of the meters discussed is interesting on account of a very perfect compensation of two sources of error—namely, change of the armature resistance and simultaneous change of the damping effect. —*Elek. Zeit.*, July 12.

Measuring Small Alternating Currents.—WERTHEIM-SALOMONSEN. A note on a new thermoelectic method of measuring small alternating currents. It is an improvement on the thermo-electric method originally proposed by Klemencic, in which the current to be measured heats a series of thermo-junctions connected to a galvanometer. In order to get over the difficulties introduced by possible asymmetry of the waves and variations in the contact resistance of the junctions, the author connects up a group of iron-constantan wires in Wheatstone's bridge form and accurately balances the resistances of the two branches which contain an equal number of junctions. Alternate junctions are built with plates having large cooling surface and fine wires to make the difference of temperature as high as possible. It is found that the deflection of the galvanometer is proportional to the square of the current, and currents of the order of 2×10^{-5} amperes can be measured.—Lond. *Elec.*, July 20.

Direct-Reading Methods of Resistance Comparison.—WOLFF.—An abstract of an American Physical Society paper giving a description of direct-reading methods employed at the Bureau of Standards for the inter-comparison of resistance standards and for the calibration of resistance boxes. The former are compared by the aid of a shunt compensated ratio set of which one arm is subdivided into four sections, each provided with a ten-step shunt dial. The total resistance is thus adjustable in steps of one-millionth with a range of one per cent. The principle may be applied to the Wheatstone bridge method and the Kelvin double-bridge method. For the calibration of resistance boxes a modification of the method of Matthiessen and Hockin is employed, the bridge wire being replaced by a series of equal coils of relatively high resistance so arranged that any desired number may be put in series. By the aid of a Varley switch, any four adjacent coils may be shunted by a circuit of equal resistance including at its middle part a bridge wire corresponding to a range of $\pm$ 1 per cent. The method may be illustrated by the following example: To compare the coils of a box of a given decade, the first coil of the next higher decade and the sum of the coils of the next lower decade, they are connected in series and joined in parallel with the calibrating apparatus. The number of steps required is given by the sum of the quotients ob-

tained by dividing the nominal values of the separate coils by their greatest common devisor, thus for a series Σ 1, 1, 2, 2, 5, 10, twenty-one are required while if a standard is included twenty-two steps are necessary. Balance readings are taken for each contact block of the box, and the differences between adjacent readings give the relative values of the coils intercompared. Connecting resistances in the box are eliminated by taking two readings at their terminals while the resistance of the leads to the calibrating apparatus is eliminated in the usual manner by transferring battery or galvanometer connections. The method is applicable wherever it is possible to apply a galvanometer contact to the contact blocks between adjacent coils, so long as the balance falls within the range of the bridge wire. The advantages of the method consist in the elimination of plug and contact resistances, in the employment of only one standard per decade, in furnishing double checks for each decade and in the relative ease and rapidity with which results are obtainable.—*Phys. Rev.*, July.

Testing Resistance of Carbons.—Kuhn.—The quality of carbons for electric purposes depends in a high degree on their electric resistance. In measuring it exactly, great difficulties are experienced in getting a good contact between the terminals of the carbons and wires which lead to the measuring instrument. Transition resistances are unavoidable and the only possible remedy is to make them constant so as to be able to eliminate them by testing two carbons of the same quality, but of different lengths. For this purpose the author recommends the use of mercury contacts. The arrangement is shown in detail in Fig. 4. The essen-

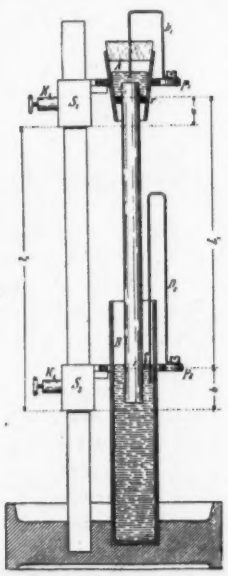


FIG. 3.—TESTING RESISTANCE OF CARBONS.

tial feature is the upper contact of the perpendicularly arranged carbon rod. For making this contact a rubber ring *r* is placed around the upper end of the carbon and this is then inserted into a cone-shaped glass or hard-rubber tube *A* filled with mercury. The lower terminal of the carbon is suspended into mercury in the vessel *B*. This method is stated to give better results than are obtainable with other methods of connections.—*Elek. Zeit.*, July 12.

Inductance and Capacity Bridge.—Palmer.—An illustrated description of simple apparatus for comparing inductances and capacities, with an accuracy of about 1/10 of one per cent., without the use of elaborate or expensive instruments.—*Phys. Rev.*, July.

Testing Low Resistances.—Burley.—An article, illustrated by diagrams for the testing of low resistances, of the order of 0.01 ohm, by means of ordinary laboratory instruments. The author uses the fall of potential method.—Lond *Elec. Eng.*, June 15.

Selenium Cell.—Raupp.—An illustrated description of various applications of the variation of the resistance of selinum cells when illuminated. This property may be used in automatic apparatus, for actuating a relay; for instance, for automatically igniting gas lamps in the evening and for extinguishing them in the morning.—*Jour. f. Gasbeleucht*, July 17.

National Physical Laboratory.—An illustrated description of the equipment of the British National Physical Laboratory, Bushey House, and especially of the electrical researches carried on there.—Lond. *Elec. Rev.*, June 22 and 29. A biographical sketch with portrait of Dr. R. T. Glazebrook, director of the National Physical Laboratory in Lond. *Elec. Rev.*, June 22.

Automatic Synchronizer.—Benischke.—A description of an automatic synchronizer of the General Electric Company for the automatic connection in parallel of three-phase alternators.—*Elek. Zeit.*, July 5.

BOOK REVIEWS.

Commande a Distance. (Long-Distance Electrical Control). Au Moyen de L'Electricité. By Regis Frilley. Paris: Gauthier-Villars. 190 pages, 94 illustrations. Price, 3.50 francs.

The volume is a little treatise on descriptive kinematic principles applied to the operative control of machinery or apparatus, at a distance, and by electric agency.

Under this classification come electric motors and their controllers, electric relay mechanisms, rotating magnetic field mechanisms, apparatus operating on the Wheatstone-bridge principle, instruments recording by means of electric sparks at regular intervals, electromagnetic escapement instruments, and apparatus operated a distance by Hertzian electric waves.

The treatment is descriptively analytic and kinematic rather than industrially practical. The various methods employed are illustrated diagrammatically.

By no means all of the electric instrumentalities employed have been covered in the book, which is, however, fairly compendious in special directions.

The work will be of special interest to the inventor, the designing engineer of remote mechanisms, and the student of long-distance control.

Elettricita e Materia. By Dr. J. J. Thomson. Milan: Ulrico Hoepli. 199 pages, 18 illustrations. Price, 2 lire.

This is an Italian translation by Dr. G. Faé of Prof. Thomson's Yale College Silliman lectures, with an appendix by the translator giving more recent Italian studies on radioactive materials.

Electric Railway Building in Oregon.

The Oregon Electric Railway Co. is entering the Willamette Valley, south of Portland, with an electric road constructed for the handling of freight as well as passengers. This road opens up a very rich territory in the center of which is located Salem, the capital of Oregon. The first section of the railroad will be fifty miles in length and will connect the city of Portland with Salem. It will be constructed, in accordance with the best railway practice, of 70-pound rails on rock-ballasted roadbed, with a maximum grade of 2.2 per cent and a maximum curvature of 5 degrees. A portion of the 50-mile line will consist of a tangent 26 miles with practically no grade. The road crosses the Willamette River, over which is being constructed a steel deck span bridge on concrete piers. There are five piers in the river, and the approaches to the bridges on either side consist of fills aggregating some thousand feet in length. The bridge proper consists of four 200-ft. spans, the distance from the rail to the surface of the river being 110 ft. This is one of the largest bridges in the State, and is being constructed for the heaviest type of electric locomotive drawing trains of 100,000-pound freight cars. The road enters the south boundary of the city of Portland and continues into the center of the city, where is located the passenger station. Connection will here be made with the Southern Pacific, Northern Pacific and Great Northern Railroads. The country through which the road passes is the garden spot of Oregon, and is extremely fertile and owing to the climate and the fact that there are no frosts or cold weather during winter time is rapidly build-

ing up with a farming and manufacturing population. There will be a number of branches aggregating some 50 miles constructed as soon as the main line is in operation, and plans are in contemplation to extend the main line to the south of Salem to the city of Eugene, making an electric railway system of some 150 miles.

All of the engineering and construction work is being done by W. S. Barstow & Co., engineers, Portland, Ore. Among the financial people interested in the enterprise are Moffat & White, bankers, New York; Chas. Pratt & Co., New York; Franklin Trust Co., Brooklyn, N. Y., and numerous other leading financiers of the East and West. This railroad is one of the first to be constructed for heavy traffic in the State of Oregon. The passenger express service will be of the best, the running time between Portland and Salem being one and one-half hour against three hours with the present railroad service.

Engine Construction During the Past Quarter Century.

In connection with the celebration of the twenty-fifth anniversary of the organization of the Ball Engine Company at Erie, Pa., it is interesting to note the progress that has been made in the construction of engines as exemplified in the output of this company. In the first engines built by the company there was introduced a new system of automatic cut-off in which the governor weighed the load. The theory of the governor was based on the principle that if a varying load requires a change of steam supply, this change should be a direct result of the load and should exactly correspond with it. In the new system the supply of steam was proportional to the load, while in the older systems the supply was in proportion to the speed. The engines were of the single-cylinder, center-crank type, and were built in sizes of from 20 to 50 hp. The performance of these engines was so satisfactory that the company was enabled to establish an industry which, although it passed through periods of national trade depression and panic, has always had work to do, and has continued to grow, until to-day the company possesses a plant which is stated to be second to none in the country.

The developments which have taken place in the design of engines, especially of those for operating electric generators, is shown in the latest types built by this company. In order to eliminate the necessity for three bearings in engines direct-connected to generators, the side-crank construction is employed in both the horizontal and the vertical machines. All of the engines, both of the Corliss and the single-valve type, are controlled by a shaft governor of recent invention, in which the centrifugal force of the weight is resisted directly by a powerful spring, and not transmitted through any bearings. This governor is exceptionally well adapted to engines driving alternating-current generators in parallel. In single-valve engines use is made of the Sweet balanced valve. In the larger engines use is made of Corliss unbalanced valves, which are so designed as to allow the valves to be stationary during the unbalanced period. This feature is employed in these engines through the use of the Armstrong non-detaching valve gear, by means of which the valves are given a positive movement, practically identical with that accomplished by detaching gears and dash-pots, the admission valves remaining absolutely motionless at least half of the time. Single-valve engines are now built in sizes of from 50 to 700 hp, and Corliss engines from 200 to 1,200 hp.

Electricity in the New San Francisco.

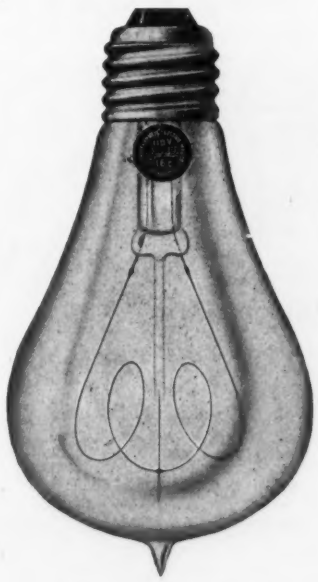
It is natural that in the new San Francisco, and in its upbuilding, electricity will have a large place, and hence there has been a good deal of activity and emulation on the part of electrical manufacturers and agencies in getting ready again for business, complete as may have been the destruction by fire and earthquake of their former offices. We are able to illustrate herewith a typical example of the energy displayed in this respect. The Shelby Electric Company, of Shelby, O., claims the honor of being the first incandescent lamp company to open an office in San Francisco after the great disaster, and Mr. O. D. Pierce, the western manager, who achieved this "hustling" feat, is seen in the

RESUMING BUSINESS IN SAN FRANCISCO.

doorway of the sumptuous shanty which served him as an office in the midst of the frightful debris and universal ruin. And there was a good deal of real business to be done—even from a modest headquarters like this.

Mill Type Incandescent Lamp.

The "Mill Type" lamp illustrated herewith has been designed for use in cases where lamps are subjected to excessive vibration, the influence of static electricity (produced by rapidly revolving belts, etc.) and hard usage of any kind. The filament is anchored at its lowest point and is supported by means of a small glass column extending from the stem past the upper portions of the filament coil. The filament is securely fastened to an anchor



MILL TYPE LAMP.

wire welded in the glass column, and the greatest possible rigidity of filament support is thus obtained. It is impossible for the filament coils to start circuit and destroy the lamp. Especially selected materials are used throughout, and the lamp is constructed to resist the hard usage which is unavoidable in certain lines of service.

The "mill type" lamp is made by the Franklin Electric Manufacturing Company, Hartford, Conn.

Induction Motor Installation for the Washoe Smelter of the Anaconda Copper Co.

Four induction motors, the largest installed west of the Mississippi River, have been supplied for the 10,000-ton concentrator of the Washoe Smelter, which forms a new portion of the $9,000,000 reduction plant of the Anaconda Copper Mining Company at Anaconda, Mont., by the Allis-Chalmers Company. This plant is to be operated by electrical energy at 70,000 volts, supplied from the two stations of the Helena Power Transmission Company on the Missouri River, near Helena, nearly 100 miles from Anaconda. The output of copper from the Washoe Smelter, which has been equipped throughout with electrical drive, is from 15,000,000 to 17,000,000 lb. per month. Formerly all the power required was supplied by steam engines, and a certain amount of steam power will probably always be used, as some of the steam boilers utilize the heat contained in the waste gases from the furnaces.

A sub-station at the smelter contains the step-down transformers for lowering the pressure to 2,200 volts for distribution to the various parts of the plant. The Anaconda Company has also recently purchased a water power plant located at Flint Creek, about 31 miles from the smelter and capable of supplying about 1,500 kw; the power from this plant will be used principally for the operation of blowers and air compressors in the smelter power house.

The concentrating plant is the first unit to be driven by electric power exclusively, the four 1,200-hp induction motors being used for this purpose. The jigs, tables, etc., are driven from a main line shaft 500 ft. long, to which the engines have been connected by rope drive and friction clutch pulleys. It is intended to leave this steam plant intact, to be used as a reserve in case the electric power fails, and disconnect the shaft at each side where it enters the engine room, thus dividing the shaft into three parts, a live section on each side of the engine room. The mill as a whole is divided into eight sections, four on each side of the engine room. Two induction motors will be installed in each half of the mill, and connected to the main shaft by rope drive and friction clutch pulleys. Each motor has a 1,200-hp output at 360 r.p.m. synchronous speed, and will furnish power sufficient to operate easily two mill sections.

These large motors (Figs. 1 and 2), designed and built by the Allis-Chalmers Company at its Cincinnati works, are notable not only on account of their large size, but also because of their having squirrel-cage rotors, something unusual in motors of this size. Their guaranteed full-load efficiency is 91 per cent and full-load power factor 92 per cent. Squirrel-cage motors are chosen for this installation because the conditions under which they have to start are favorable, and also because of the higher power factor of this type as compared with the wound rotor type. The motors, being connected to friction clutches, start up light, and as the mill runs continuously it is not expected that the motors will be started at all frequently. The power system of the Missouri River Power Company is so large that the occasional starting of one of these motors will not cause undue disturbance, while the higher power factor under ordinary running conditions is a decided advantage. Tests show that those motors exceed the guaranteed power factor of 92 per cent, and that the starting current taken from the line will not exceed full load running current when starting the motor with its ropes and friction pulley connected.

Starting is effected by an oil-immersed controller connected to an auto-transformer which lowers the applied voltage at starting. The controller has six stops so that the motor can be brought up to speed gradually. Since the motors are arranged in pairs in the mill, one controller is provided for each pair of motors, and the necessary instruments, switches, etc., are mounted on two two-panel marble switchboards placed near the motors. The controller is operated by means of a hand wheel on the front of the board.

The main switches and also the transfer switch for connecting either motor to the controller are of the oil-immersed type and interlocked with the controller handle in such manner that it is impossible to close the main switch of either motor while the controller is at the "on" position.

The stator punchings of the motors are supported in a substantial yoke to which the housings carrying the bearings are bolted. The bearings are adjustable to permit compensation for wear and thus maintain a uniform air-gap between stator and rotor. The stator is wound with copper strip with the slot insulation formed around it under pressure in steam-heated moulds. The end connections of the windings are rigidly supported to prevent any distortion due to abnormally large current. The rotor is mounted on a spider provided with cast-steel end rings between which the laminations are held. The rotor slots are of the partially closed type and the rotor bars are securely held in place by the overhanging tips of the teeth. The bars are bolted at each end to bronze short-circuiting rings, thus making a very strong rotor that can be safely run at high peripheral speed.

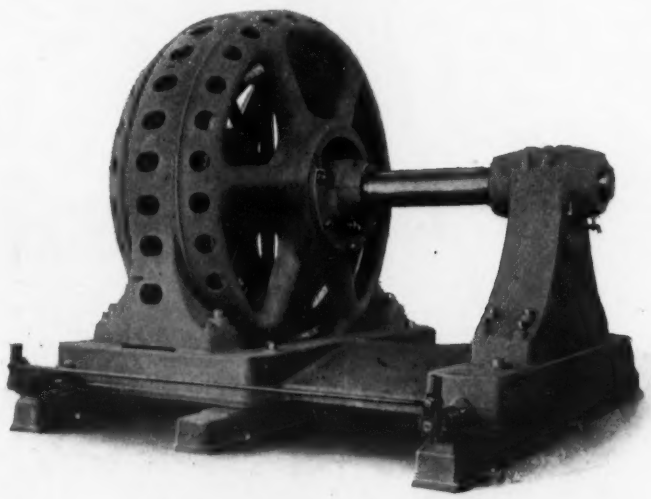


FIG. 1.—1,200-H.P. INDUCTION MOTOR.

FIG. 2.—ROTOR OF 1,200-H.P. INDUCTION MOTOR.

In addition to the four large motors, there is also provided a 200-hp, variable-speed, 60-cycle, 2,080-volt induction motor for operating the pumps in the mill. This motor, shown in Fig. 3, has a wound rotor and collector rings for the insertion of resistance in the secondary. The normal speed is 450 r.p.m. and

can be reduced to 225 r.p.m. by means of a grid type resistance furnished with the motor. This motor also has adjustable bearings.

For the equipment of the sub-station the Allis-Chalmers Company has furnished three synchronous motor-generator sets of 300 kw output each, and one small induction motor-generator set for starting and exciting the synchronous sets. The 300-kw sets are driven by 12-pole, 2,080-volt, 60-cycle synchronous motors and run at a speed of 600 r.p.m. The direct-current generators for these sets are compound-wound for 550 volts and are easily able to carry 50 per cent overload for two hours without heating more than 55° C. and without sparking. At normal full load the temperature rise does not exceed 35° C. in any part. The sets have three bearings and the stator of the synchronous motor is arranged to slide sideways on the base to give access to the field and armature windings. These units will be used for operating direct-current crane motors throughout the plant and also for furnishing power to the Anaconda Street Railway. During parts of the day the load will be quite light and it is intended to operate the synchronous motors with over-excited fields so as to compensate to some extent for the lagging current caused by the induction motors.

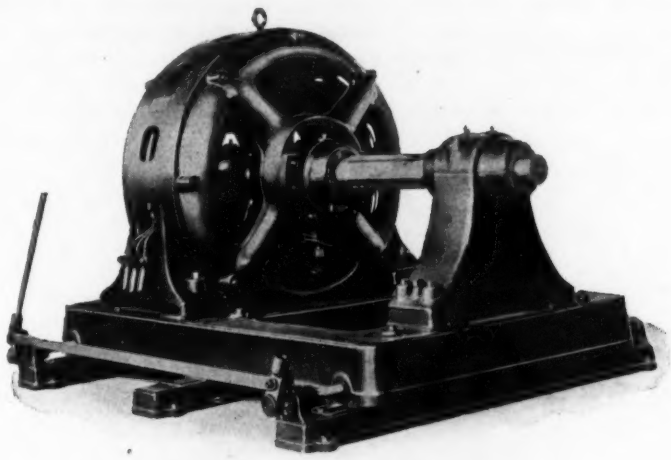


FIG. 3.—2CO-H.P. VARIABLE SPEED INDUCTION MOTOR.

The fields of the synchronous motors are excited from a 120-volt, 25-kw, direct-current generator driven by an induction motor. The same motor is also coupled to a small 500-volt, direct-current machine which supplies current for starting the sets. This machine has commutating poles and a very large current can be taken from it for short intervals without sparking at the commutator or undue heating in any part of the machine.

Semenza High-Tension Insulator.

Fig. 1 shows in outline and section a new Italian insulator of the Semenza type. As will be seen, the wire is fastened below the upper petticoat; consequently, this petticoat is not subject to perforation and need merely be water-tight and sufficiently hard to withstand mechanical shocks and rough usage in transportation. It can thus be made of a material not so costly nor so breakable as porcelain or glass. Since the point of attachment of the wire in the Semenza type is much lower than in the old style of insulator, the strain moment of the wire is much reduced, thus enabling some reduction to be made in the thickness of the insulator and also in the diameter and cost of the iron pin. As this upper petticoat or "umbrella" is not connected in any way with the pin, complications due to increased capacity are avoided.

Figs. 2 and 3 show a breakdown test on insulators of the old and new type. The insulators were placed under exactly the same electrical conditions, their heads being connected by the same wire to one terminal of a transformer and both iron pins immersed in an alkaline bath connected to the other terminal of the transformer. It will be noticed that the porcelain part of the Semenza insulator, while resisting the test better than the old type, is considerably smaller. Fig. 4 shows a Semenza insulator under a voltage of 111,000 and a spray corresponding to a rainfall of 1,000 mm. (39 in.) per hour. The exact discharge air-gap is shown by a graduated scale which stands beside the insulator, the discharge taking place between a needle point and the surface of the alkaline bath in which the iron pin is placed. This scale also gives a good idea of the dimensions of the insulator.

The manufacturers state that the saving in price of the Semenza insulator over the usual type is between 30 and 40 per cent for an equally safe installation for working tensions in the neighborhood of 35,000 to 50,000 volts; and that this saving increases with the working tension and reaches 50 per cent where a working pressure of 80,000 to 90,000 volts is employed. It is further claimed that tests with a driving rain do not make any difference in the results as shown by experiments; and even if any difficulty were anticipated, the size of the umbrella could be correspondingly increased without any material difference in price.

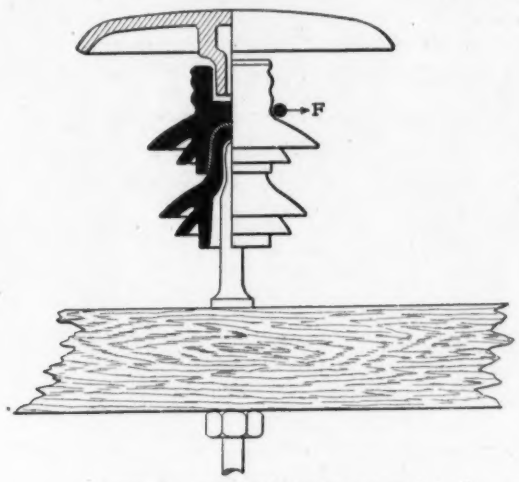
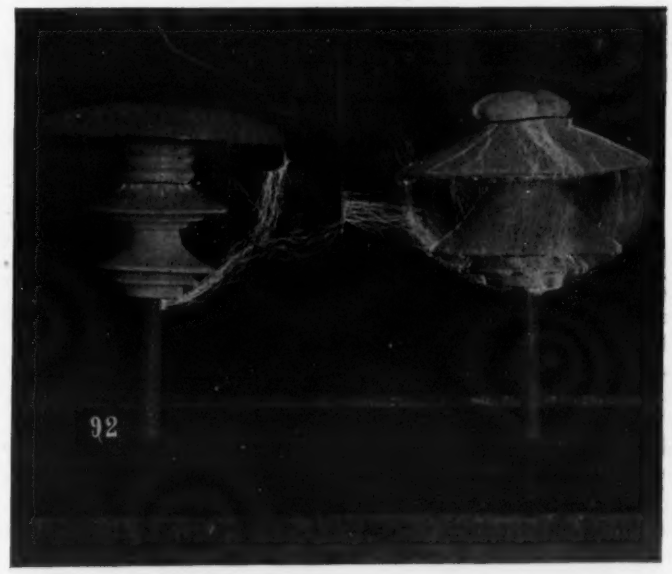


FIG. 1.—SEMENZA INSULATOR.

Signor Semenza considers that one of the reasons for the remarkable results so far experimentally achieved is that the wire is at no point in touch with a stream of water actually running over the surface of one of the effective petticoats of the insulator. The tests show that the value of this insulator is not affected by heavy films of moisture, and the most important effect of the "umbrella" is to screen the wire and the effective surface of the insulator from "live" water. Owing to the sag of the wire there is no tendency for water collecting on it to run on the insulator, and any tendency for a stream of water to run directly off the "umbrella" on to the wire could be overcome by cupping the



FIGS. 2 AND 3.—COMPARATIVE TEST OF OLD AND NEW TYPE OF INSULATOR.

edge of the "umbrella" at the point immediately above the line wire.

The model shown in Fig. 4, which breaks down under a heavy spray at 111,000 volts, breaks down when absolutely dry at 122,000 volts; that is to say, with this type of insulator the breakdown point under the heaviest rain storms would be in the neighborhood of 90 per cent of the breakdown point when dry.

The insulator illustrated is the invention of Signor Guido

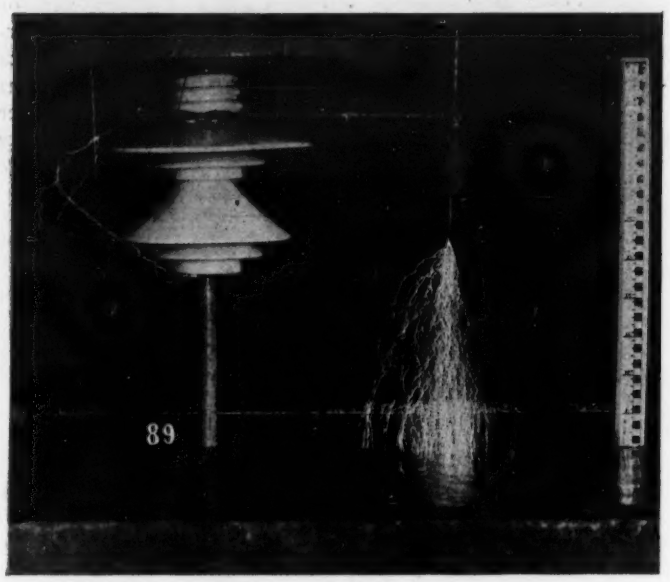


FIG. 4.—TEST OF SEMENZA INSULATOR UNDER 111,000 VOLTS.

Semenza, secretary of the Italian Institution of Electrical Engineers, and its details have been perfected by the engineers of the Societa Ceramica Richard-Ginori after a great number of experimental trials made at the electrical testing laboratory connected with the works of that company at Doccia, near Florence.

Automatic Feeder Regulators.

For the automatic voltage regulation of individual feeder circuits for both power and lighting the General Electric Company manufactures two forms of voltage regulators, shown in the accompanying illustrations. The general principle of operation of both forms is similar in that they are in effect variable ratio transformers or compensators having two separate windings. The primary or shunt winding is connected across the line while the secondary or series winding is connected in series with the line to be controlled. While both forms of regulator boost or lower the voltage by changing the transformer ratio the method used in the cases are quite different.

In the one type of regulator (Fig. 1) the windings are assembled on a shell type core and taps are brought out from the secondary winding to stationary slip rings. The various combinations of turns producing the voltage change are made by the controlling mechanism of the regulator. In the other type of regulator (Fig. 4) the secondary and primary windings are assembled upon separate cylindrical and concentric sheet-iron cores. The series or secondary winding is arranged in slots on the inside circumference of the stationary outer core, and the shunt or primary winding is placed in similar slots on the outside circumference of the movable inner core. The change in the angular position of these cores varies the flux distribution and so produces the boost and lower in the voltage. The coils on both stationary and movable cores are in effect polar windings and both are similarly wound. With a given pole of the primary opposite a given pole of the secondary, the regulator will boost the line voltage while if dissimilar poles are opposite the voltage will be lowered.

The mechanical arrangements of the regulators are compact and simple. In the regulator of Fig. 1 the connection changes are made by a rotating switch (Fig. 5). The moving member of this switch carries a series of fingers, each of which is connected to a corresponding stationary collector ring by means of a suitable brush and the ring is connected to the line through a preventative resistance. This resistance allows a small exchange of current between the fingers and thereby prevents any break in the circuit when passing from one step to another. The switch is operated on a vertical shaft by a bevel gear which in turn is driven by magnetic clutches on the horizontal shaft, the switch rotating in one direction or the other, depending upon which clutch is excited.

In the regulator of Fig. 4 the mechanical arrangement is exceedingly simple. The movable or primary core is mounted on a vertical shaft, the upper end of which carries a worm gear segment while the other end rests in a step bearing. Both primary and secondary windings are brought out by means of flexible cables with the exception of large regulators for rotary converters which have the secondary arranged with bus-bar terminals. The entire arrangement is simple and substantial in construction and with the exception of the windings is practically indestructible.

Both types of automatic regulators are operated by polyphase

FIG. 1.—AUTOMATIC FEEDER REGULATOR.

motors, but the method of control is different. In the movable core regulator (Fig. 4) the operation is as follows: Across the potential transformer in the feeder line is placed a contact-making voltmeter (Fig. 3), the regulator being in series with the line. As the line voltage rises or falls the contact-making voltmeter responds, making contact on one of two points respectively. These contacts in turn close the circuits in a relay switch (Fig. 2), which starts the polyphase motor. This relay switch operates the motor in either direction, according to the "boost" or "lower" position taken by the contact-making voltmeter. The motor then revolves, adjusting the main circuit voltage by changing the angular position of the cores as described, until the line voltage becomes normal. At that instant the contact-making voltmeter opens, in turn opening the relay switch and the motor circuit.

In the regulator of Fig. 1 the contact-making voltmeter forms an essential part of the control, but the relay switch is omitted.

In this type of machine the driving motor, which may be of any type, revolves continuously, but operates the revolving switch mechanism (Fig. 5) only when the magnetic clutches on the horizontal shaft are energized. A single motor may operate a number of regulators. The contact-making voltmeter, responding to the rise and fall of the line voltage, as in the case of the other regulator, sends a direct current through one or the other of the clutches. These clutches then rotate the switch by means of the mechanical arrangement of the bevel gear drive, as explained. If it is desired to compensate for line drop and maintain a constant potential at some distant point on the feeder it is only necessary to provide the relay with a compensated winding, connected in series with the line, or through a suitable current transformer. The compensated winding on the relay is arranged with two sets of dials as shown, so that a very close adjustment can be obtained within the limits for which the device is designed. In the regulator of Fig. 4, where there is considerable inertia in the moving parts, a magnetic brake operates when the motor circuit is opened, which prevents hunting, but this device is not required on the first type since the parts are light and stop when released by the clutches.

Each of these regulators has its individual application according to the operating conditions. The regulator shown in Fig. 1 is particularly designed for feeder circuits where the fluctuations in voltage are very rapid. Such conditions are imposed when both lamps and induction motors are operated on the same circuit. The rush of current taking place when a large induction motor is thrown on the line makes the lamps flicker unpleasantly unless a quick-acting regulator is provided. This type of regulator meets these conditions and smooths out the fluctuating voltage curve, as it operates over its full range from lower to boost in six seconds. The second type, on the other hand, is well adapted for lighting circuits where the load comes on more gradually and such quick regulation is not essential, as for example the regular lighting load at a power station, which increases rapidly toward night fall.

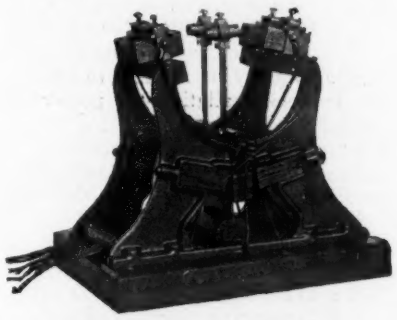


FIG. 2.—RELAY SWITCH.

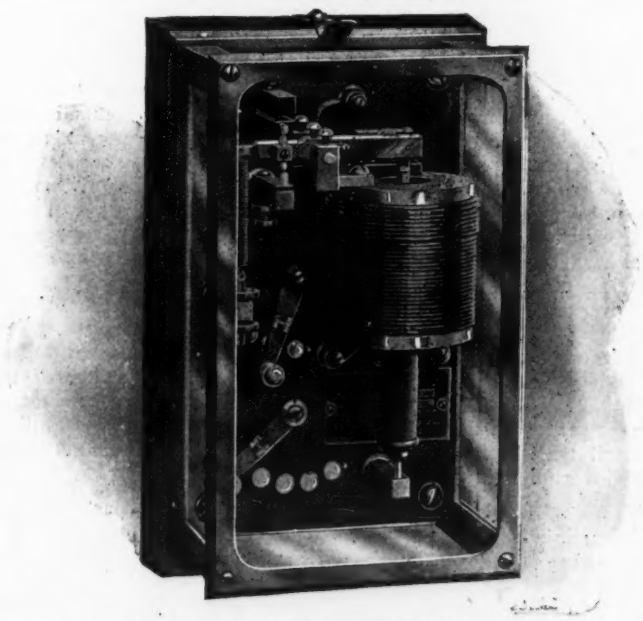


FIG. 3.—CONTACT MAKING VOLTMETER.

While both these types of regulators have very good efficiencies and power factors, these are of relatively small importance. Take for example the regulator of Fig. 4. Feeders seldom require a regulation exceeding 20 per cent and a regulator having even as low a power factor as 85 per cent does not have any appreciable effect on the line. Such a regulator would have a magnetizing current and a reactance exceeding 25 per cent, and assuming that the regulator is arranged for a 10 per cent boost and lower, and that the power factor on the line is 100 per cent, the effect of the regulator having this low power factor and with full load on the line, will only reduce the power factor on the line 0.2 per cent; in other words, the power factor would become 99.8 per cent. With a 5 per cent boost and lower regulation under the same conditions the line power factor would be 99.9 per cent. It is therefore evident that the reactance in the regulator has a negligible effect on the power factor of the system as a whole.

FIG. 4.—AUTOMATIC FEEDER REGULATOR.

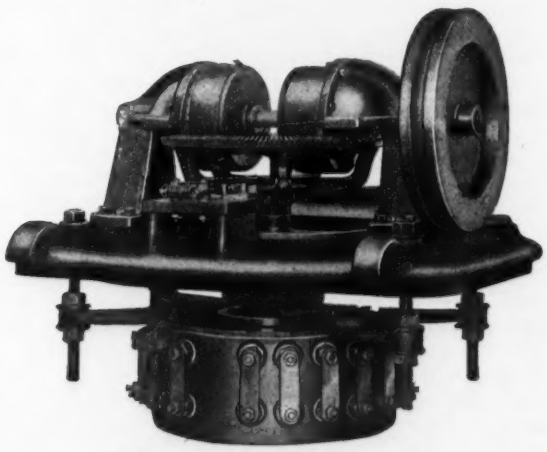


FIG. 5.—SWITCHING MACHINE.

Both types of regulators are built in standard sizes for 60 cycles and 2,200 volts, to boost and lower the voltage either 5 per cent or 10 per cent above and below normal. The regulator of Fig. 1 is usually built in sizes from 11 to 22 kw, while the other type for single or polyphase circuits ranges in size from 5.5 kw to 44 kw. Their capacity, however, is practically unlimited and has already been extended to 1,200 kw.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Trade reports are especially gratifying from the Northwest and other points that are dependent upon agricultural results, but all sections of the nation enjoy great prosperity, and there is scarcely a discordant note in any of the dispatches. Scarcity of labor is the only serious complaint, output of coke being curtailed, and there is delay in harvesting some crops, while strikes retard the rebuilding of San Francisco; but, on the other hand, a slight modification of the 1903 scale has brought back 8,000 more bituminous coal miners, and the threatened struggle at 33 paper mills has been averted, while advanced wages brought full activity in the textile industry. Commodity prices are fairly steady, cheaper grain because of large crops being offset by strength in the leading materials of manufacture. Railway earnings in July were 8.9 per cent larger than a year ago, and foreign commerce at the port of New York shows gains of $3,353,669 in imports and $483,006 in exports, as compared with the same week last year. The most significant feature connected with the iron and steel markets is the further development of confidence growing out of the resumption of dividends on the common stock of the United States Steel Corporation, which, in addition, reports a record mid-year volume of unfilled orders, amounting to 6,809,589 tons. The scarcity of steel-making irons is as pronounced as ever, and midsummer activity in the mills is unprecedented. Finished materials are in brisk demand, and in rails some business has been taken for Mexico and Porto Rico. Copper is quiet but firm, the closing quotations being 18¾c. for Lake, 18⅜ for electrolytic, and 18¼ for casting stock. The essential soundness of mercantile trade is testified to by the July and seven months' returns of failures, which point to fewer failures and smaller liabilities than in any but the best of years. *Bradstreet's* reports 170 business failures during the week ending Aug. 2, as compared with the same number the week previous, and 178 during the corresponding week last year.

RECENT ALLIS-CHALMERS SALES.—The Allis-Chalmers Company reports among recent sales the following.—Electrical Department: E. M. Statler, Buffalo, N. Y., two 125-kw generators, 50-kw generator; Wood & Brooks Co., Buffalo, N. Y., 125-kw generator and 9-kw belted exciter; Manhattan Rubber Manufacturing Co., Passaic, N. J., 150-kw. generator; Allis-Chalmers-Bullock Co., Ltd., Montreal, Can., two 175-kw direct-current generators; Watab Pulp & Paper Co., Sauk Rapids, Minn., 40-hp motor, 5-hp motor, and 35-hp. D. C. variable-speed motor; N. R. Allen Sons Co., Kenosha, Wis., 600-kw generator, 15-kw. direct-connected exciter and 150-hp motor; Woodward Iron Co., Woodward, Ala., three 400-kw rotary converters, six 75-kw O. F. S. C. transformers, 50-kw motor-driven exciter and switchboard. Steam Engine Department: Cleveland Electric Railway Co., Cleveland, O., 32 in. and 68 in. x 60 in. Reynolds heavy-duty cross-compound condensing Corliss engine; Elk Cement & Lime Co., Petoskey, Mich., 16-in. by 30-in. Reynolds Reliance Corliss engine and power station auxiliary apparatus; Ansonia Brass & Copper Co., Ansonia, Conn., 19-in. and 38-in. by 42-in. Reynolds combined horizontal and vertical engine with two fly-wheels; United Gas Improvement Co., Philadelphia, Pa., 26-in. and 54-in. by 54-in. Reynolds heavy-duty cross-compound Corliss engine. Contracting Department: Salt Lake Turbine Publishing Company, Salt Lake City, Utah, three Reynolds Reliance Corliss engines, three D. C. generators of 100, 150 and 250-kw capacity, two 25-kw balancer sets, three 15-kw balancer sets, complete power station auxiliaries including boilers, feed-water heaters, switchboard, piping, stack, etc.; Indianapolis, Newcastle & Toledo Ry., Indianapolis, Ind., complete power station, including building and all steam and electrical equipment, consisting of two 1,000-kw A. C. turbo-generators, six 350-kw transformers, nine 150-kw transformers, three 150-kw transformers, four 400-kw rotary converters, eight 75-hp quad-railway motor car equipments, eight complete Christensen air-brake equipments, complete switchboard equipment, boiler plant, three sub-stations, and 5,000 tons 70-lb. steel rail. Gas Engine Department: Indiana Steel Co., Gary, Ind., seven 2,000-kw gas engine generating units, two 2,000-kw D. C. gas engine generating units; Illinois Steel Co., Bay View Mills, Milwaukee, Wis., 32-in. by 42-in. tandem gas engine, 500-kw D. C. generator; Trenton Iron Co., Trenton, N. J., 350-kw gas engine generating unit. Mining Department: Bullychoop Gold Mining Co., Trinity County, Cal., complete hydraulic electric transmission and mining equipment, including a 20-stamp mill, induction motors, a 450-kw generator, direct connected to water wheels, and a transmission line 3½ miles in length. Mill Department: Dempsey Lumber Co., Tacoma, Wash., engines, generators and motors for complete power and lighting plant.

THE GOULD STORAGE BATTERY IN CANADA.—Owing to the growth of business with consequent demands for a closer base of operations the Gould Storage Battery Company has found it necessary to establish a Canadian branch with offices at 62-64 Wellington Street West, Toronto, Ont. This office has been placed in charge of Mr. P. B. Yates. Besides the regular line of storage batteries for load regulation, in connection with a Gould counter e.m.f. booster, on street railway, lighting and power plant systems, the company is manufacturing storage batteries for use in train lighting and also for telephone and telegraph work. An excellent example of the economies effected is found in the case of the Galt, Preston & Hespeler Railway of Galt, Ont. The company installed a battery of 230 Gould cells, having a capacity of 107 kw, to be used as a "floating battery." Before the installation the power required by the passenger cars prevented any development of freight traffic, and attempts to push the latter seriously interfered with the passenger service. The company is now running freight trains of six to eight cars without interference with the regular passenger schedules. Another case in point is that of the Lexington Street Railway Company, of Lexington, which installed a battery of 280 Gould cells, having a capacity of 346 kw and working with a Gould counter e.m.f. booster. Previous to the installation the power house was overloaded and could not well carry the peaks of the load. At present, with the aid of the battery, these peaks are being taken care of while the arc-light circuit, power load and car service of the town is handled without trouble.

SPRINGFIELD, MASS., WATER POWER.—The partnership properties of the Springfield Water Power Company, which was formed about two years ago for the development of water power rights on the south branch of Mill River, have been transferred by deed to Thomas C. Page, of Chicopee Falls, in trust. The old company was Roscoe R. Moody and Clinton Gowdy, of Springfield, and George H. Smith, of Holyoke. The members of the new company which will develop the power rights on the south branch have not been announced. These power rights were formerly to have been acquired by the J. Stevens Arms & Tool Company, of Chicopee Falls, for the purpose of furnishing power by an electric plant for the company's works in Chicopee Falls. The Government intervened, however, before the deal was consummated and declined to permit any company to develop more power at these points than was represented by the average flow of the stream. As a consequence, the Stevens Company made an adjustment and relinquished its plans. The Government is at present in virtual control of the situation, although it has no more rights than any riparian owner of individual privileges downstream, and any further development of the power at the Sixteen Acre Mill property and the Phillips Russell tract in Plum Tree road will probably be submitted to the Government first for approval.

STANDARD UNDERGROUND.—The Pacific Coast manager of the Standard Underground Cable Company, Oakland, Cal., under date of July 23, has issued the following notice: "Possibly you have learned from the more or less distorted newspaper reports of the destruction of our Oakland factory by fire on Saturday night of last week. We are pleased to advise, however, that the engine and boiler house escaped with the loss of the roof, and that the insulating tanks and drying ovens are intact. We were fortunate in having a new lead press and steam pump already en route from the East and expect to have temporary repairs made and our lead covering department in operation again within about two weeks. Meanwhile, we are erecting temporary buildings for the storage of new stock, and beg to assure you that we are prepared to handle your orders practically without delay, as we already have two carloads of new stock in the Oakland freight yards, and ten more cars now en route from our Eastern factories, and we will be filling orders to-morrow. We

also take occasion to advise that on August 1 we will reestablish a San Francisco office, temporarily located at 332 Bush Street (between Montgomery and Kearney), for the convenience of our city patrons, but for the present our main Pacific Coast offices will be continued in the Bacon Block, Oakland, Cal., where all correspondence should be addressed."

A LARGE SHIPMENT.—We have received an interesting photograph showing one of the largest single shipments recently made from the works of the Westinghouse Electric & Manufacturing Company. The photograph was taken just as the train was pulling out of the East Pittsburg yards, its destination being the Nauser Lake power plant of the Helena Power Transmission Company at Iron Siding, Montana. The train was composed of 19 cars and the shipment consisted, among other apparatus, of the following: Four 2,800-kw Westinghouse revolving field generators, 3-phase, 2,400 volts, 7,200 alternations, 227 r.p.m., these generators being intended for direct connection to water wheels; two 200-kw direct-connected exciters, 125 volts, compound wound, 475 r.p.m., these also being intended for direct connection to water wheels; nine 2,000-kw water-cooled transformers, 7,200 alternations, 70,000 volts primary, 2,400 volts secondary. A large quantity of auxiliary detail apparatus was included in the shipment.

RECENT STURTEVANT SALES.—The B. F. Sturtevant Co,. of Boston, Mass., enumerate among recent sales of generating sets these for the following parties: Rand-Avery Supply Co., Boston, Mass.; H. J. Kunzig, Philadelphia, Pa.; High Rock Knitting Co., Philmont, N. Y.; W. W. Gleckner & Sons Co., Canton, Pa.; Wrentham Hat Co., Wrentham, Mass.; City & Suburban Home Co., New York City; MacArthur Bros. Co., Glen Lyn, Va. Two standard economizers are being installed by the B. F. Sturtevant Co. for the American Steel & Wire Co., Worcester, Mass. These will serve 3,000 boiler horse power. The following recent sales of horizontal centre-crank automatic engines, completely enclosed, with forced lubrication under 15 lbs. pressure, have been made by the company: to the High Rock Knitting Co,, Philmont, N. Y.; Wren tham Hat Co., Wrentham, Mass.; City & Suburban Home Co., New York City; Missoula Light & Water Co., Missoula, Mont.

NOBLESVILLE, IND., POWER PLANT.—The United States Geological Survey has reported adversely on the power plant proposition at Noblesville. Four years ago a company was formed to build a dam and power plant in White River, near Noblesville. It was stated to the company that a 2,000-hp plant could be operated with the flow of the river. A timber dam sixteen feet was almost completed, turbines were ordered and a power house and wheel pit built, some $40,000 being expended. During the winter of 1903 the dam was washed out, and before rebuilding the company asked Government experts to estimate the power. A test station was established and a daily gauge kept for a year. The report is very disappointing. Instead of showing a 2,000 hp, it is only 200 hp. It will cost $75,000 to complete the plant, and estimating the 200 hp at $30 a horsepower, it would not return a fair profit on the investment.

WORK IN CHINA.—The concession for the supply of water, and for electric lighting in the city of Newchwang, has been secured by an Englishman, and British capitalists will be offered the investments. According to a correspondent of London *Commercial Intelligence,* negotiations are now going on for the electric lighting of the native city of Shanghai, and the contract for this is likely to be secured by a German firm. The greatest development of all is taking place in connection with railways, and the Chinese themselves are forming companies and raising capital for building the lines. It would seem a good opportunity for railway contractors to secure some good business. So long as there is nothing in the shape of a concession or exclusive control, the Chinese are willing to cooperate with contractors for the building of the various lines.

AUTOMATIC TELEPHONE CONTRACT.—A contract has been signed between the Home Telephone Company of Spokane and the Automatic Electric Company. It calls for the building and installation of a 3,500 line automatic exchange of the most modern type, together with power appliances, telephones, etc. San Diego, Los Angeles, San Francisco and Oakland, Cal.; Portland, Ore.; Walla Walla, Tacoma, Bellingham and Spokane, Wash., all having automatic installations, will be important factors in an extensive long distance system being worked out on the Coast by local capital.

THE DE LA VERGNE MACHINE COMPANY, New York, reports the following recent orders for "Hornsby-Akroyd" oil engines: Wheaton Seminary, Norton, Mass., 13 hp; P. R. Manufacturing Company, Detroit, Mich., 50 hp; Rahr Brewing Company, Oshkosh, Wis., 32 hp; The Vitagraph Company, Brooklyn, N. Y., 25 hp; Regal Oil & Gas Company, Chicago, Ill., 65 hp; L. R. Wright, Pecos, Tex., 13 hp; Jas. H. Holden, Fall River, Mass., 75 hp; Borough of Souderton, Souderton, Pa., 50 hp; James L. Breeze, Southampton, L. I., 35 hp direct-connected to 25 kw generator.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards at the following places: Palouse, Wash.; Georgetown, S. C.; Cumberland, Md.; Goldfield, Ia.; Provo, Utah; Morton, N. Y.; Parma, Idaho; North Adams, Mich.; Indianapolis, Ind.; Moultrie, Ga.; Oakman, Ala.; Newtonville, Mass.; Clyde, Ohio; Logan, Utah; Rochester, N. Y.; New Castle, Ky.

STOMBAUGH GUY ANCHORS.—The importance of the Stombaugh guy anchor in the construction field will be appreciated when it is learned that recently W. N. Matthews & Bros., of St. Louis, Mo., made a shipment to the Hobson Electric Company in Texas of a carload of five-inch and six-inch anchors valued at more than $3,800. A single telephone company received more than three-fourths of this carload.

SUPPLIES IN SEATTLE.—The Western Electric Company, Seattle, Wash., has been incorporated, with a capital stock of $25,000, by George E. Wright, P. J. Aaron and E. M. Scribner, with an office at 439 New York Block, shipments being made through branches at San Francisco, St. Paul or Chicago. Within a short time a permanent office will be established, carrying a complete stock of electrical supplies and machinery.

NEW LAMP FACTORY.—General Manager Wood, of the Fort Wayne Electric Works, has closed a contract whereby a plant will be established at Fort Wayne to manufacture incandescent electric light globes. It will be a branch of the Harrison, N. J., concern of the General Electric Company.

THE WIRELESS OFFICES of the De Forest system at Hartford and Bridgeport, Conn., are, it is said, being discontinued.

Financial Intelligence.

THE WEEK IN WALL STREET.—Active bullish manipulation continued throughout the week, accompanied by rumors of deals, while the declaration of a 1 per cent dividend on United States Steel common had a good effect. Toward the close of the week the activity diminished and irregular recessions appeared as the result of realizing sales. The condition of the money market was regarded as favorable to the bullish tendencies of the Stock Exchange, it being duly noted that the arrangements made by the Treasury to increase largely the government deposits in the banks have obviated any disturbance whatever on account of payments of subscriptions for the Panama canal bonds. Electric and traction stocks were somewhat irregular. Allis-Chalmers common closed at 17½, a net decline of ⅜, and preferred at 49, a loss of ¼ point. General Electric advanced ¾-point net on the week's business, the closing price being 168½, and Westinghouse receded 2 points, the last quotation being 151. American Locomotive, common and preferred, both declined, the former closing at 69, ex. div., and the latter at 113⅜. A fair business was transacted in Brooklyn Rapid Transit, which closed at 78½, this quotation

NEW YORK

	July 31	Aug. 7		July 31	Aug. 7
Allis-Chalmers Co.	17⅛	17¼	General Electric	168⅜	167
Allis.Chalmers Co. pfd.	48	48¼	Hudson River Tel.	...	...
American Dist. Tel.	25	25	Interborough Rap. Tran.	...	...
American Locomotive	72⅜	69½	Mackay Cos.	74¾	74
American Locomotive pfd.	113	113½	Mackay Cos. pfd.	72¼	72⅜
American Tel. & Cable	90	90	Marconi Tel.	...	...
American Tel. & Tel.	125	125	Metropolitan St. Ry.	...	...
Brooklyn Rapid Transit	78	80⅛	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	91⅛	91¾
Electric Boat pfd	55	55	Westinghouse com.	150	151
Electric Vehicle	10	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	*40	...			

BOSTON

	July 31	Aug. 7		July 31	Aug. 7
American Tel. & Tel.	133½	133	Mass. Elec. Ry. pfd	69	70
Cumberland Telephone.	115½	...	Mexican Telephone	...	...
Edison Elec. Illum.	237	238	New England Telephone	131	...
General Electric	166	...	Western Tel. & Tel.	11	...
Mass. Elec. Ry.	20¼	20⅛	Western Tel. & Tel. pfd.	88	...

PHILADELPHIA

	July 31	Aug. 7		July 31	Aug. 7
American Railways	52⅛	52	Phila. Electric	8	8
Elec. Co. of America	11⅛	11	Phila. Rapid Trans.	30⅛	30¼
Elec. Storage Battery	72	71⅛	Phila. Traction	...	99
Elec. Storage Battery pfd.	...	...			

CHICAGO

	July 31	Aug. 7		July 31	Aug. 7
Chicago City Ry.	160	160	National Carbon	84	84
Chicago Edison	136	138	National Carbon pfd.	121	117
Chicago Subway	46	46¼	Union Traction	...	...
Chicago Tel. Co.	121	...	Union Traction pfd.	...	...
Metropolitan Elev. com.	27	28			

* Asked

representing a net gain of 1 point. On the other hand, Inter-Metropolitan declined 1⅝ on the common and ½ point on preferred, the closing quotation being 36⅞ and 77⅛, respectively. Metropolitan Street Railway closed at 107½, a net advance of 4⅛ points. Other quotations at the end of the week were as follows: American District Telegraph, 25; American Telegraph & Cable, 90; American Telephone & Telegraph, 125; Electric Storage Battery, 86 asked; Havana Electric Railway, 47½; Michigan State Telephone, common, 50, preferred, 91; New York and New Jersey Telephone, 127½. The curb market participated in a moderate way in the rise in the general market, though transactions were small. The closing quotations of Aug. 7 are given in the table herewith.

THE WESTINGHOUSE REPORT was referred to last week, when its leading statistics were quoted. The following paragraphs, of great interest as to the foreign business of the company, are from the separate report of President Westinghouse. He says:—"As indicated by the financial statement, these large interests are in the following foreign companies: First—The British Westinghouse Electric & Manufacturing Company, Limited, London, England. Second—Société Anonyme Westinghouse, Paris, covering France, Spain, Portugal, Italy, Belgium, Switzerland and Holland and their dependencies. Third—Westinghouse Electricitäts Actiengesellschaft, Berlin, for Germany. Fourth—Westinghouse Electric Company, Limited, London, of which all shares are owned by your company and has all territory not covered by the companies named. Keen competition with manufacturers in Europe and the usual difficulty in starting new plants have thus far prevented returns upon the money invested in these foreign enterprises, but it may be stated with confidence that the business of each of these interests will, in the near future, be brought to a condition which will make these investments profitable. The recent securing of important contracts, aggregating six million dollars, from the municipal authorities of St. Petersburg, Russia, for the construction of electric tramways in that city, resulted in negotiations between important French bankers, who controlled a suitable modern electric manufacturing plant in Moscow. These negotiations have resulted in the formation of the Société Westinghouse Electrique de Russie, organized under French laws, to purchase these works and the electric business which has been developed by the electric department of the Société Anonyme Westinghouse of St. Petersburg (the Russian Brake Company) on a most favorable basis and which will cover all expenditures in developing the electric department besides increasing your assets by nearly one million dollars. The immediate working capital for this new company has been supplied by the financial interests referred to, and the new company thus starts in business with large orders in hand under exceptionally favorable conditions, financially and otherwise, with a strong board of direction and experienced Russian officials who have been identified with your affairs for several years. There are further important pending operations which may soon result as favorably for your company as has the business in Russia just referred to." The annual report names the following as the officers of the company:—Board of Directors: A. N. Brady, New York; N. Willis Bumstead, Boston; George W. Hebard, New York; E. M. Herr, Pittsburg; J. H. Hyde, New York; Brayton Ives, New York; Ph. Ferd. Kobbe, New York; George C. Smith, Pittsburg; George Westinghouse, Pittsburg; H. H. Westinghouse, New York. Officers: Brayton Ives, chairman; George Westinghouse, president, Pittsburg; E. M. Herr, first vice-president, Pittsburg; L. A. Osborne, second vice-president, Pittsburg; Newcomb Carlton, fourth vice-president, New York; George W. Hebard, acting vice-president, New York; Walter M. McFarland, acting vice-president, Pittsburg; Chas. A. Terry, secretary, New York; T. W. Siemon, treasurer, New York; H. F. Baetz, assistant treasurer, Pittsburg; E. St. John, assistant treasurer, New York; James C. Bennett, general auditor, Pittsburg; F. E. Craig, assistant auditor, Pittsburg; W. B. Covil, Jr., assistant auditor, Pittsburg. Manufacturing Department: Alex. Taylor, manager of works; and F. W. Cox, A. Victorin, J. H. Zimmerman, assistant managers of works. Engineering Department: B. G. Lamme, chief engineer; H. P. Davis, assistant chief engineer; C. F. Scott, consulting engineer. Sales Department: C. S. Cook, manager railway and lighting department; S. L. Nicholson, manager industrial and power department; C. B. Humphrey, manager detail and supply department; Maurice Coster, manager export department. The new directors are Messrs. T. W. Siemon and W. D. Uptegraff.

INTERNATIONAL DYNELECTRON.—The following is quoted from the Worcester, Mass., *Telegram*, and will be of interest to those who have invested in the dynelectron: "International Dynelectron stock, liberally invested in by Worcester people, while not paying dividends is not the dead one it was supposed to be, according to John W. Knibbs. Not that Mr. Knibbs has any confidence that the stock will ever amount to anything, but having been the prime factor in marketing the stock in Worcester, Mr. Knibbs feels it incumbent upon him to make good in some way for inducing his friends to invest in a losing venture. He has given to his friends for the stock in the International Dynelectron Company stock in a corporation, which has been recently organized, and of which he is president. The only conditions imposed in the exchange of stock being that the holders of the old stock pay into the new company 10 per cent of its par value. The new company is in no way related to the old and is not to market any dynelectrons. It is expected that the product of the company will revolutionize the power propulsion of steam locomotives and stationary engines. No need of any smoke stacks or cumbersome coal tenders or coal. The American Consolidated Power Company will attend to that. The company was incorporated in Arizona with an authorized capital of $25,000,000."

BROOKLYN EXTENSIONS BLOCKED.—At a meeting of the directors of the Brooklyn Rapid Transit Company it was decided that the attitude of the borough authorities of Brooklyn was such as to compel the company to defer all efforts to extend its lines over routes for which new franchises have to be obtained. President Winter said that the requirements for efficient operation had been fairly met, and that the next step was naturally the development of outlying property. "It has been the desire of the company to take this up with the present season and push the construction of lines with as much energy as has been given to the other work referred to. How this movement has been defeated and the supplying of transportation facilities to outlying districts made still more remote by the interposition of one obstruction after another, is a matter of public knowledge. The Brooklyn Rapid Transit Company is beyond the danger line of financial reverses arising from the refusal to grant privileges, or the imposition of such terms and conditions as necessarily preclude their acceptance."

PITTSFIELD ELECTRIC ANNUAL.—The annual meeting of the Pittsfield Electric Company was held last week. The following officers were re-elected: President, Alexander Kennedy; treasurer, William A. Whittlesey; directors, the above with James W. Hull, Charles E. Merrill, Henry R. Peirson, Samuel G. Colt and William L. Adam. Reports showed the company to have done an excellent business in the past year. The gross income was $140,677. Last year's report showed a business of $122,000. The company's capital stock is $150,000, bonded at $100,000. There is other indebtedness of $90,000. The company's property is valued at $323,000. It is expected that the company's new plant at Silver Lake will be ready for occupancy by October 1. The company finds that the increase in business is due to a demand for small motors used in small manufacturing plants. The company pays an eight per cent dividend.

DIVIDENDS.—The directors of the Niles, Bement, Pond Company have declared the regular semi-annual 3 per cent dividend on the preferred stock, payable in two installments. The first payment is payable August 15. On the common stock they have declared the regular semi-annual 3 per cent dividend, payable in two installments. The first payment will be made September 20 and the second on December 20. The directors of the North American Company have declared the regular quarterly dividend of 1¼ per cent, payable September 1, to stockholders of record at close of business August 15. The books do not close.

MEXICAN TELEPHONE BUSINESS.—The annual report of the Mexican Telephone & Telegraph Company for the year ending February 28 gives the subjoined figures of instruments and earnings:

	1906.	1905.	1904.	1903.
Telephones in service.....	5,626	5,182	4,904	4,478
Gross (Mexican currency)...	$319,666	$298,131	$274,876	$246,368
Net	$162,833	$139,381	$134,885	$111,997

AMERICAN LIGHT & TRACTION.—The American Light & Traction Company shows for the first six months of 1906 a gross of $1,047,535, a surplus after dividends of $106,269, and a net surplus of $2,235,145. The investment assets of the company are $27,498,168. There is $14,222,100 of preferred stock and $15,000,000 of common stock.

KANSAS CITY EARNINGS.—The Kansas City Railway & Light Company reports $457,788 gross for June, expenses of $245,102, charges and taxes of $142,026 and a surplus for the month of $70,660.

GENERAL NEWS.

Construction News.

ANNISTON, ALA.—The cost of installing a municipal electric light plant in this city has been estimated at about $30,000.

MONTGOMERY, ALA.—The Montgomery Light & Water Power Company will soon install a storage battery in its power plant for street railway service. R. J. Chambers is manager.

SHEFFIELD, ALA.—The Sheffield Company will increase the capacity of its power plant this year. The company will install a 1,000-kw Parsons turbine, a 200-kw rotary and a 300-hp Wickes boiler. J. B. McClary is manager.

GREENVILLE, ALA.—The Henderson Light & Power Company contemplates putting in a day service, and will install a 35-kw generator; also engine and boiler of sufficient capacity to operate the same. C. C. Henderson is proprietor.

DOTHAN, ALA.—Extensive improvements are now being made to the municipal electric lighting plant. The system is being changed from direct to alternating current; new engines and water tube boilers are being installed. W. E. Culver is superintendent.

ANDALUSIA, ALA.—The Andalusia Light & Water Company will make extensive improvements and additions to its power plant. The company will soon install a 120-hp Harrisburg engine, and a 70-kw, 2,300-volt General Electric generator with switchboard equipment. J. H. Morgan is superintendent.

TUSKEGEE, ALA.—The City Council has purchased the machinery for the municipal electric light system, which will double the capacity of the plant. A 105-kw alternating-current, three-phase, 60-cycle General Electric generator, direct connected to a 164-hp Harrisburg engine and a 100-hp Lombard boiler will be installed. The city is also adding 50 enclosed arc lamps to its lighting system. It is expected to have the plant finished and in operation by September 1. Carl N. Browne is superintendent.

JONESBORO, ARK.—The city has purchased the property of the Jonesboro Water & Light Company. J. F. Christy is manager.

SEARCY, ARK.—The Board of Light Commissioners is contemplating installing a storage battery in the municipal electric light plant. W. H. Walkup is superintendent.

BATESVILLE, ARK.—The citizens are contemplating extending the water and light service of the municipal light and water plant, and will probably install a new engine. John C. Bone is manager.

BENTON, ARK.—The Benton Light, Power & Ice Company is contemplating the construction of a street railway system, and will install a 125-kw direct-current generator to operate the same. E. Y. Stinson is president.

TEXARKANA, ARK.—The Texarkana Light & Traction Company was sold at auction to L. S. Mitchell, secretary of the Commonwealth Trust Company, of St. Louis, Mo., for $125,000. The sale was made subject to the approval of the federal court.

SANTA PAULA, CAL.—The Santa Paula Electric Company contemplates the erection of five miles of suburban line for lighting purposes.

ALAMEDA, CAL.—A 275-kw alternating-current National Electric generator, direct connected to a 4-valve Fleming tandem compound engine, is now being installed in the municipal electric lighting plant. Joseph B. Kahn is superintendent.

MENOVIA, CAL.—The Edison Electric Company is enlarging its territory and will include Duarte and Sierra Madre, the extensions to be completed about August 1 and September 1 respectively. A larger distributing station is being built at Primrose and Chestnut Avenues.

GEORGETOWN, CAL.—The El Dorado Electric Railway Company will make application to the Board of Supervisors at its next meeting for a franchise to construct and operate a railroad from the city of Sacramento to Lake Tahoe by the way of the Georgetown divide. W. T. Phipps, of Sacramento, is attorney for the company.

REDLANDS, CAL.—A large irrigation project promoted by San Francisco and Redlands capitalists includes a plan to turn the waters of Strawberry Creek into Lake Hemet, using them to generate electricity for supplying Hemet, the Webster Ranch and Oak Cliff. Preliminary surveys for both the cement ditch and the transmission line have been made by Rasor Brothers, of San Bernardino, under the supervision of Manager P. N. Myers of the Hemet Water Company. A 7-mile canal will have to be constructed.

STEAMBOAT SPRINGS, COL.—The Steamboat Springs Electric Company is erecting a new power house, and will greatly increase the capacity of its power plant. D. L. Carver is superintendent.

PAGOSA SPRINGS, COL.—The Pagosa Springs Electric Light & Power Company is considering the question of operating its plant by water power and may install another generator. E. M. Hampton is manager.

DURANGO, COL.—The citizens have voted in favor of granting an electric light franchise to Thomas Loftus and partners. The company proposes to construct a plant costing $25,000 and have secured a site for a reservoir 4 miles from town.

PUEBLO, COL.—The Pueblo & Suburban Traction & Lighting Company is remodelling its plant entirely. The company will install two General Electric generators, of 1,100 kw capacity, 2,300 volt, 3 phase, 60 cycles, one Rice & Sargent cross compound condensing engine of 1,200 hp capacity. The new machinery and auxiliaries will cost about $75,000. John F. Vail is manager.

WESTPORT, CONN.—The Westport Water Company contemplates extending its lines to Green Farms. F. B. Hubbell is manager.

WINDSOR LOCKS, CONN.—The George P. Clark Company is installing a new electric generator to operate its mill with electric power.

BRIDGEPORT, CONN.—The Connecticut Railway & Light Company has awarded a contract to the H. Wales Lines Company, of Meriden, Conn., for the construction of an addition to its power plant on Seaview Avenue, the capacity of which is to be increased by the installation of a new engine of 1,200 hp.

WALLINGFORD, CONN.—The capacity of the municipal electric light plant is being increased by the development of additional water power of 150 to 200 kw capacity. A transmission line of three miles will be built to the present power house, which is expected to be in operation by May 1, 1907. A. L. Pierce is manager.

MIDDLETOWN, CONN.—Sealed proposals will be received until August 15 by the Finance Committee of the Connecticut Hospital for Insane, Middletown, for mason work, steel, fireproofing, sheet metal work, etc., necessary to complete a fireproof power house. Plans and specifications were prepared by William D. Johnson, architect, 26 State Street, Hartford, Conn.

DANBURY, CONN.—The New York, New Haven & Hartford Railroad Company has awarded to the Fairbanks Construction Company, of Chicago, Ill., the contract for the construction of a coaling station in Danbury. The structure will be 32 by 132 feet, and will be equipped with hoisting apparatus and overhead dumps. The hoisting device will be operated by electricity.

WILMINGTON, DEL.—Mayor Wilson on August 3 returned to the Street and Sewer Department with his veto the franchise requested by the Commercial Light, Heat & Power Company.

GEORGETOWN, DEL.—The Georgetown Light, Heat & Power Company is considering the installation of a 300-hp Diesel oil engine in its power plant, and extending its lines to Milton and Millsboro, a distance of 9 miles. L. D. Shont is manager.

BARTOW, FLA.—The managers of the municipal electric lighting plant are contemplating extending the line to East Bartow. D. E. Bivins is superintendent.

ARCADIA, FLA.—The Arcadia Electric Light, Ice & Telephone Company will soon install a day service and also a series arc circuit. E. Scott is manager.

LAKE CITY, FLA.—The new municipal electric light plant will be completed in about two months, when the old plant will be abandoned. The new plant will be equipped with a 240-kw Stanley alternator, and one 120-kw Warren alternating-current dynamo; one 370-hp automatic engine and a 200-hp Atlas Corliss engine, and three Lombard boilers of 450 hp capacity. F. A. Farwell is superintendent.

CORDELLE, GA.—Extensive additions and improvements are being made to the plant of the Citizens Electric Light & Power Company's plant in this city.

SUMMERVILLE, GA.—W. W. McLaughlin and J. F. Stephens, of Lindale, have been making investigations with a view of putting in an electric plant in this place.

ALBANY, GA.—The Albany Power & Manufacturing Company contemplates installing an additional turbine and generator of 1,000 kw capacity. E. S. Killebrew is superintendent.

CEDARTOWN, GA.—The city is contemplating the construction of a complete electric plant, consisting of new engines, generators, switchboards and arc lighting system. W. D. Ivey is superintendent.

ATLANTA, GA.—The Atlanta & Carolina Railway Construction Company has applied to the County Commissioners for a charter to build an electric railway from the city limits of Atlanta to the DeKalb County line.

MARIETTA, GA.—The Georgia Manufacturing & Public Service Company is making extensive improvements and increasing the capacity of its plant. A new generator, engine and motors are being installed. H. Albert is manager.

CARROLLTON, GA.—The Carrollton Electric Company contemplates making extensive improvements to its plant, and will install an alternator of from 75 to 100 kw capacity, a 150-hp engine and a 5-ton ice plant. C. R. Turner is president and manager.

MACON, GA.—A 1,500-kw Curtis turbo-generator set with a 500-kw rotary converter is now being installed in the plant of the Macon Railway & Light Company. The company has recently replaced the city light-

ing system with General Electric series alternating-current enclosed-arc lamps. J. T. Nyhan is manager.

CARTERSVILLE, GA.—The contract for the construction of the new electric light plant has been awarded to the Electric Supply Company, of Savannah, by the City Council. The plant will be equipped with a Harrisburg engine and Cole boilers. The street lighting system will provide for 55 arc and 69 incandescent lamps. The Electric Supply Company proposes to establish an electrical supply business in this city.

LEWISTON, IDA.—The Lewiston-Clarkston Company is installing two 750-kw Westinghouse generators, direct-connected to two 1,600-hp Doble water wheels to increase the capacity of its plant. Frank C. Kimball is general manager.

POCATELLO, IDA.—The American Falls Power, Light & Water Company has commenced work on the erection of a new power house, which will have a capacity of 20,000 hp when completed. P. U. Bliss is general superintendent.

BENTON, ILL.—The municipal electric lighting plant in this village will be rebuilt. I. J. Dillon is chief engineer.

ROODHOUSE, ILL.—The Roodhouse Electric Company is contemplating installing an alternating-current system in its plant.

MONMOUTH, ILL.—The Monmouth Gas & Electric Company is constructing a new power house. L. C. Mainland is manager.

DELAVAN, ILL.—The Royal Light & Power Company is planning to install a tubular boiler in its plant this fall. M. H. Few is manager.

GREENUP, ILL.—A new dynamo of 80-kw capacity is now being installed in the municipal electric lighting plant. D. H. Rowe is manager.

COULTERVILLE, ILL.—A storage battery is now being installed in the electric light plant in this village. T. M. Matthews is owner and manager.

ALPHA, ILL.—The Tri-County Light & Power Company is contemplating extending its line to Moline and Henderson, Ill. W. I. Taze is general manager.

MEDORA, ILL.—We are informed that a storage battery will soon be installed in the electric light plant for day service. Frank Watson is owner and manager.

ASTORIA, ILL.—The Astoria Electric Light, Heat & Power Company will install a 200-hp Skinner engine in its plant. W. O. Falkenstein is secretary and manager.

LAWRENCEVILLE, ILL.—The Lawrenceville Light & Water Company is contemplating making improvements and remodeling its plant. Charles G. Arnold is superintendent.

BEARDSTOWN, ILL.—The Beardstown Electric Light & Power Company will establish an alternating-current day service. W. E. McCullough is treasurer and manager.

SULLIVAN, ILL.—The citizens are considering the question of installing a new Corliss engine of 250 hp in the municipal light and water plant. John F. Denton is manager.

FISHER, ILL.—The Warner & Wardlow Electric Company contemplates installing a storage battery in its electric light plant for day load. A. L. Wardlow is secretary and manager.

PAXTON, ILL.—The Paxton Electric Company is contemplating the rebuilding of its plant and adding new dynamos, engines and extending its lines to other towns. J. D. Roberts is manager.

AURORA, ILL.—A new 350-kw generator made by the Western Electric Company and a Ball engine are now being installed in the municipal electric lighting plant. C. C. Hinckley is chief electrician.

CORNELL, ILL.—M. J. Rhodes, owner of the electric light plant, writes that he will install two 65-hp boilers and an 80-hp engine in his plant this fall, and expects to establish a day service when the new machinery is placed.

McLEANSBORO, ILL.—The citizens are considering the question of installing a new engine of 200 hp in the municipal electric lighting plant, and adding 44 enclosed-arc lamps to the street lighting system. R. G. Allen is superintendent.

GALESBURG, ILL.—The citizens are contemplating installing a 60-kw alternator and a 90-hp Frost engine in the municipal electric light plant to increase the capacity of the plant, so as to light the city buildings. George Mesplay is manager.

ZION, ILL.—Additional boilers of 500 hp, made by the Sterling Boiler Company, are being installed in the Zion electric light plant; the Russell engine has been replaced by a 250-hp Ridgeway. The company contemplates installing a hot water heating system.

ELMWOOD, ILL.—The Elmwood Electric Light Company contemplates changing the frequency to 60 cycles and the purchase of a 200-kw alternator and engine. The company will also establish a day power service and install motors. E. L. Brown is owner and manager.

STREATOR, ILL.—The Illinois Light & Traction Company, which is a consolidation of the Peoples' Light & Railway Company and the Streator Gas & Light Company, has completed its new power house and combined the plants of the two companies. The company has spent about $50,000 in improvements, including the rebuilding of the entire city lighting plant and the installation of the General Electric series alternating-current street lighting system. R. W. Harris is general manager.

KENDALLVILLE, IND.—A new 150-hp boiler will soon be installed in the municipal electric light plant. T. E. Johnson is superintendent.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company will erect a new power house in the near future. C. E. Layton is manager.

CHURUBUSCO, IND.—A new dynamo of larger capacity will be installed in the water and light plant this fall. Miss J. Kingdon is owner and manager.

SYRACUSE, IND.—P. O. Wood & Company have leased the plant of the Syracuse Power, Light & Manufacturing Company and will establish a day service.

THORNTOWN, IND.—An additional boiler will be installed in the municipal electric lighting plant this coming Fall. W. E. Young is superintendent.

BOSWELL, IND.—The Boswell Electric Light & Water Works Company is now installing a 145-hp four-valve engine in its plant. E. E. Maher is manager.

AUBURN, IND.—A new 100-kw Warren alternator and Haberkorn engine of 150 hp has recently been installed in the municipal electric light plant. John L. Lewis is manager.

RICHMOND, IND.—The Richmond Light, Heat & Power Company is contemplating the installation of new boilers and rebuilding the engines. J. D. Taylor, Jr., is acting manager.

DECATUR, IND.—The city is contemplating the installation of a series alternating-current system of street lighting in the municipal electric lighting plant. M. J. Mylott is superintendent.

FORT WAYNE, IND.—The City Council will hold a special session to take up the Pearl Street franchise and also the contract for the new power house of the water works department in this city.

CRAWFORDSVILLE, IND.—The Crawfordsville Electric Light & Power Company contemplates installing two new direct-connected units and a new switchboard during the coming year. James R. Thomas is superintendent.

BRAZIL, IND.—Housey Johnson and W. J. Murphy are at the head of a movement to organize a company to build twenty miles of interurban road to connect this city with Clay City. It is stated that the right of way will be donated.

CAYUGA, IND.—The Cayuga Electric Company is contemplating extending its lines to Kingman, a distance of 14 miles. The company has secured the contract for lighting the streets of Kingman for a term of ten years, and is to furnish 15 arc lamps at $75 per lamp per year. J. W. Shaw is manager.

NOBLESVILLE, IND.—The Noblesville Hydraulic Company has been granted a twenty-five year franchise to furnish electricity in this city. The rates fixed in the franchise are 8 cents per kw-hour for domestic lighting and 6 cents per kw-hour for heating and power purposes. The company has already begun work on the construction of its dam on White River, near the city. It is claimed that 2,000 hp can be generated. The dam, when completed, will represent an investment of $125,000. The turbines and other equipments will be ordered soon.

CAMBRIDGE, IA.—W. A. Curtis is contemplating the construction of an electric lighting plant in this place.

ESSEX, IA.—The Shenandoah Electric Company has secured the contract for lighting the streets of this city.

SIOUX CITY, IA.—The Crystal Lake Amusement Company will install an electric light plant at Crystal Falls, near Sioux City. Address W. R. Burch, care Crystal Lake Amusement Company.

IOWA CITY, IA.—The Trustees of the State University of Iowa have awarded to the Dubuque Turbine & Roller Mill Company the contract to furnish four 51-inch turbine wheels, with line and shafting and attachments, each turbine to furnish 82 hp under 7 feet head, the cost to be $8,104.

ACKLEY, IA.—The Ackley Electric Light, Power & Heating Company is contemplating extensive improvements and additions to its plant. The company will install a high pressure boiler, a Corliss engine of 125-hp, direct connected to two generators of 75-kw capacity and a heater. H. H. Nazett is manager.

CLAY CENTER, KAN.—Bids will be received until August 15 for the construction of a new electric lighting plant. W. K. Palmer, of Kansas City, Mo., is the consulting engineer.

OTTAWA, KAN.—Contracts have been let by the City Council to Roy W. Stookey, of Belleville, Ill., and to the Electric & Steam Engineering Company, of St. Louis, Mo., for remodeling and improving the municipal water and light plant.

FORT LEAVENWORTH, KAN.—Bids will be received until August 20 by Captain J. C, Normoyle, Q. M., U. S. A., for furnishing and installing electric fixtures and watt meters in certain buildings and extending the electric lighting system at Fort Leavenworth.

PONCHATOULA, LA.—The Flasdick-Rixman Lumber Company has let the contract for the construction of an electric light plant.

BIDDEFORD, ME.—The York Light & Heat Company is extending its lines to Ervin and the Pines for electric lighting service.

EASTPORT, ME.—It is reported that a proposition for furnishing the city with street and other lamps will be submitted to the City Council at the regular monthly meeting in August by the Citizens' Electric Light & Power Company. It is stated that the work of installing the plant will commence at once.

KENNEBUNK, ME.—Work has commenced on the new power house at New Dam station on the Atlantic Shore Line Railway, owned by the Alfred Light & Power Company. The building will be 50 x 28 ft., two stories high, and will cost about $4,000. Two double water wheels, two transformers of 600 hp capacity will be installed and in operation by September 1.

HYATTSVILLE, MD.—The contract for installing an electric light system has been awarded to the Potomac Electric Power Company, of Washington, D. C., at $12 per lamp per year for 30-cp incandescent street lamps, and $65 per lamp per year for arc lamps. The contract will extend over a period of 10 years, and the town will probably contract for 150 incandescent lamps. Bonds to the amount of $12,000 were recently sold for this improvement.

WOBURN, MASS.—The City Council is now considering the question of the establishment of a municipal electric light plant.

MARLBORO, MASS.—The Marlboro Electric Light Company has commenced the work of replacing the old lamps with new enclosed arc lamps.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has been granted a franchise in Duxbury, and will soon extend its lines to that town for lighting purposes.

LAWRENCE, MASS.—The Lawrence Gas Company has petitioned the Board of Gas and Electric Light Commissioners for permission to increase its capital stock by $400,000.

BOSTON, MASS.—The Joint Committee of Municipal Lighting of the City Government has employed John Campbell to prepare statistics on the subject of municipal lighting.

WINCHENDON, MASS.—The Winchendon Electric Light & Power Company is contemplating moving from its present quarters to Harrisville, where there is an excellent water power.

WORCESTER, MASS.—The Worcester Electric Light Company has petitioned the Board of Gas & Electric Light Commissioners for permission to increase its capital stock by $200,000.

MIDDLEBORO, MASS.—Contracts have been placed by the electric light committee for a 300-hp gas producer plant complete in two units, and for a 125-hp Westinghouse gas engine. The committee also has under consideration the purchase of a new generator of 150 hp capacity and a Marinette gas engine.

LEOMINSTER, MASS.—The Board of Gas and Electric Light Commissioners has issued an order authorizing the Leominster Electric Light & Power Company to issue additional capital stock of a par value of $30,000 for the payment of floating indebtedness and 20-year 5 per cent bonds to the amount of $70,000.

WESTFIELD, MASS.—Several manufacturing firms in this town are substituting electricity for steam to operate their plants. The H. W. Gladwin Company has ordered a 7½-hp motor, the Moore machine-shop a 10-hp motor and the Horse Whip Company will install two additional motors aggregating 20 hp at once. Several other firms are contemplating the use of electric power.

NEW BEDFORD, MASS.—The Board of Gas and Electric Light Commissioners has issued an order on the petition of the New Bedford Board of Trade, reducing the price of gas and electricity supplied by the New Bedford Gas & Edison Light Company, of New Bedford. The price of gas is reduced from $1 to 90 cents per thousand and of electricity from 18 cents to 14½ cents per kw-hour.

QUINCY, MASS.—The Board of Gas and Electric Commissioners has issued an order reducing the price of electricity furnished for commercial purposes by the Quincy Electric Light & Power Company to a net rate of 17 cents per kw-hour, the rate at the time the petition was brought being 20 cents per kw-hour, with reductions for prompt payments, ranging from 10 to 25 per cent. The reduction is to take effect Aug. 1.

WEBSTER, MASS.—The Consolidated Railway Company has begun preliminary operations for the construction of an electric railway from Norwich through Jewett City and Plainfield to Central Village. At the last point the road will connect with the Danielson, Webster & Putnam Division of the company's system, and the line will be the connecting link of a continuous trolley from New London, Willimantic and Norwich to Worcester and Boston.

BOSTON, MASS.—A new interurban street railway is in process of formation. The new company is to be known as the Boston, Lowell & Lawrence Street Railway Company, and is to be run from Sullivan Square to Lowell. The company is to have a capital stock of $250,000. The following are the temporary directors: Paul Butler, Lowell; Butler Ames, Lowell; Oakes Ames, North Easton; Spencer Borden, Jr., Fall River, and Charles F. Remington, Woburn.

STOUGHTON, MASS.—Extensive additions and improvements are contemplated by the Stoughton Light, Heat & Power Company, which will double the capacity of its plant. A new 200-hp engine and generator will be installed as soon as possible. The town recently voted to add 80 25-cp incandescent lamps and one additional arc lamp, making a total of 75 arc and 83 incandescent lamps on the streets. The company is furnishing several industrial establishments with electricity, and as soon as the improvements are completed several additional concerns will take energy from the company to operate their plants with electricity. F. S. Barton is manager.

AMHERST, MASS.—The Massachusetts Public Service Company has been formed at Amherst for the purpose of providing for taking electricity from the plant of the Turners Falls Company's plant at Turners Falls. It is stated that the company has contracted with the Turners Falls Company to supply it with electricity not exceeding 5,000 hp, to be delivered in Amherst over a line which the new company will build between this city and Turners Falls. The principal object of the company is to supply the Amherst Gas Company with electricity. The directors are Edwin D. Marsh, C. Fred Deuel, Mason A. Dickinson, David Barry and James F. Barry, all of Amherst.

DULUTH, MINN.—The City Council has adopted a resolution to ask for bids for municipal lighting on 1, 3 and 5-year periods.

PAYNESVILLE, MINN.—The citizens are considering the replacing of the municipal electric light plant with an entire new plant.

CHISHOLM, MINN.—The Chisholm Light & Power Company contemplates the construction of a dam on the Sturgeon River and will develop 600 hp.

COLUMBIA, MISS.—The Progressive League, consisting of business men of this city, is interested in securing electric lights and water works for the town.

JACKSON, MISS.—The new power plant of the Jackson Street Railway Company is nearly completed and will soon be ready to supply the street railway system and the city with electricity. The plant when completed will cost about $100,000. The company has recently received a carload of new enclosed arc lamps to be used in the street lighting system.

ST. LOUIS, MO.—The Anheuser Busch Brewing Company will construct an electric light plant at a cost of $30,000.

ST. LOUIS, MO.—The West End Business Men's Association is contemplating the establishing of a municipal lighting plant.

APPLETON CITY, MO.—It is reported that bids are wanted until August 15 for $10,000 electric light bonds. G. A. Gheilman is mayor.

KALISPEL, MONT.—The Kalispell Water & Electric Light Company contemplates extending its service.

MISSOULA, MONT.—M. R. Rutherford, of this city, is endeavoring to procure an electric light franchise in Plains. If a franchise is granted Mr. Rutherford will construct an electric light plant at a cost of about $25,000.

WEST BRANCH, NEB.—The City Council has passed an ordinance granting a franchise to the Cuming County Independent Telephone Company.

GRAND ISLAND, NEB.—Work has commenced on the new municipal electric light and water plant, to be constructed on North Pine Street.

NASHUA, N. H.—The capital stock of the Nashua Light, Heat & Power Company has been increased by the issuance of 1,000 shares.

FREMONT, N. H.—Eli J. Gagnon has bought the Robinson mill and water privilege of the Spaulding & Frost Company, which he will soon convert into an electric light plant. A new 200-hp engine has been placed in the plant and many other improvements will soon be made.

RAHWAY, N. J.—The installation of a municipal lighting plant is reported under consideration.

CAMDEN, N. J.—The City Council has decided to submit to the people the question of the municipal ownership of an electric light, heat and power plant, at the general election to be held November 6.

NEWARK, N. J.—The Common Council on August 3 adopted the recommendation of Runyon & Carey, of Newark, that an independent lighting plant be installed in the new city hall, and passed a resolution requesting the City Hall Commission to take steps in accordance with the report of the engineers as soon as possible.

WEST ALBANY, N. Y.—The Schenectady Illuminating Company has been awarded the contract for lighting the streets of the village with incandescent lamps.

PLATTSBURG BARRACKS, N. Y.—Bids will be received until August 14 by Capt. Edward T. Hartmann, Quartermaster, U. S. A., for electric wiring a hospital here.

LOCKPORT, N. Y.—A bill is to be presented to the Council before Nov. 3 for submission to the next session of the Legislature, permitting the city to install a municipal electric light plant.

NEW YORK, N. Y.—It is announced that the New York Central Railroad Company has finally secured the controlling interest in the Little Falls & Dolgeville Railroad. The road is about 10 miles long. It is understood that the new owner has decided to electrify the road and extend it to Canada Lake, 10 miles north of its present terminal in Dolgeville.

DEANSBORO, N. Y.—At a joint meeting of the Town Boards of Kirkland and Marshall held recently a franchise was granted to O. C. Blanding for a term of fifty years to erect and maintain an electric light and power plant. A contract was also made with Mr. Blanding to furnish seven arc lamps of 2,000 cp. for $50 per lamp per year for a term of five years.

CORINTH, N. Y.—Preparations are being made by the Corinth Electric Light Company to increase the capacity of its plant for the purpose of installing a day power service. As soon as improvements are completed the E. H. Benway Excelsior Company will operate its plant by electricity; the motor has already been installed and the wiring completed. Other industries are contemplating operating their plants by electricity as soon as the company is prepared to furnish the energy. Warren Curtis, Jr., is owner and general manager.

RALEIGH, N. C.—The Raleigh Electric Company will make extensive additions to its plant in this city.

BILTMORE, N. C.—George W. Vanderbilt has made a contract with the Weaver Power Company to furnish electricity for Biltmore and for the Biltmore House.

HOT SPRINGS, N. C.—The Hot Springs Manufacturing Company is installing an electric light plant for the purpose of lighting the city of Hot Springs by electricity.

ROCKINGHAM, N. C.—Plans have been completed for the development of 12,000 hp immediately and 28,800 hp ultimately on the Yadkin River, 8 miles from Rockingham.

CHARLOTTE, N. C.—The Consolidated Construction Company has been granted the right of way for a line to run 12 miles to the Catawba River, with a three-mile line to suburban cotton mills. E. D. Latta is president.

ENDELIN, N. D.—A. M. Abbott, of Portal, has been granted a franchise to erect and operate an electric lighting plant in this place.

WILLISTON, N. D.—At an election held recently the citizens voted in favor of installing an electric light and water works system at a cost of $27,000.

BUFORD, N. D.—Plans and specifications are on file in the office of the Electrical World, 114 LibertyStreet, New York, N. Y., for the installation of three transformers of 300 kw. capacity and eight motor-driven pumping units of capacities of 16 and 30 cubic feet per second under heads of 50 and 33 feet, respectively, with necessary electrical apparatus and water pipes, in pumping stations near Buford, bids for which will be opened on September 10, at the office of the U. S. Reclamation Service, at Williston, N. D.

FREMONT, OHIO.—The Fremont Yaryan Company has purchased the plant of the Fremont Electric Light & Power Company from the Logan National Gas & Fuel Company.

PIQUA, OHIO.—The Council has passed a resolution to appropriate $500 to secure the services of an electrical engineer to make estimates on the cost of installing a municipal electric light plant.

DESHLER, OHIO.—The electric light plant in this place owned by the First National Bank, of Findlay, has been sold to Sumner Cottingham. Mr. Cottingham recently secured the contract for street lighting in this city.

CLEVELAND, OHIO.—Bids will be received until Aug. 17 by the Board of Public Service for furnishing and erecting on foundations at the Cleveland municipal electric light plant two mechanical stokers complete and ready for connection to piping; also one condenser unit complete. A. R. Callow is secretary.

LA GRANDE, ORE.—The Grande Ronde Electric Company contemplates extending its system so as to furnish electric lights to the residents of May Park and Fruitdale.

LOCK HAVEN, PA.—The Long Electric Light, Heat & Power Company has been granted a charter to furnish light, heat and power in the towns of Mill Hall, Salena and adjacent territory.

EPHRATA, PA.—The Borough Council has contracted with the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., to change the system of the electric light plant from direct to alternating current, the cost to be about $3,986.

CHESTER, PA.—Capitalists represented by John L. Garrett, a local attorney, have made a proposition to the light committee of the Councils to erect a $100,000 electric light plant, and at the expiration of 10 years to turn the plant over to the city.

PITTSBURG, PA.—The Pittsburg, Newcastle, Butler & Harmony Street Railroad, which is to connect the cities named, has let contracts for the construction of the line, a distance of about seventy miles. The bond issue of $3,500,000 has been taken by the Union Trust Co.

ERIE, PA.—The stockholders of the Mutual Telephone Company will meet October 1 to take action on the proposed increase of capital stock from $150,000 to $500,000. The increase of stock asked for is for the building of new lines and for increasing the facilities of the company.

CONNELLSVILLE, PA.—The West Penn Electric Company, which recently came into possession of all the light and power systems between Riverview and Brownsville, is making many changes and is practically rebuilding the lighting system in the upper Monongahela Valley. The company expects to supply these towns with electricity from its plant located in New Haven early in August.

CHARLESTON, S. C.—Bids will be received until September 1 by Mordecai T. Endicott, Chief Bureau of Yards and Docks, Navy Department, Washington, for electric wiring and lighting in joiner shop, Navy Yard, Washington.

LOUDON, TENN.—It is stated that M. R. Goans is contemplating the construction of an electric lighting plant here.

SEVIERVILLE, TENN.—W. T. Walker and M. B. McMahan are considering the construction of an electric light plant two miles from Sevierville to light the town.

UVALDE, TEX.—The machinery for the new electric light plant is placed and the plant is nearly ready for operation. The company is contemplating the construction of a street car system, and installing an ice plant in the near future. E. L. Burks is manager.

DALLAS, TEX.—Mercer Carter and associates have been granted a franchise over many streets in Dallas. The first-mortgage, 5 per cent., 30-year gold bonds to be issued will be limited to $30,000 per each completed mile of track with its rolling stock and power. A power plant of 1,250 hp will be installed in three units, one of 600 hp, one of 350 hp, and one of 300 hp. In Dallas there will be laid 17 miles of main-line track, including 6 miles of double track. Correspondence with contractors and material men is desired.

LEXINGTON, VA.—It is reported that as soon as plans are completed, bids will be received for the construction of a power plant building and electrical and mechanical work for a central steam heating and electric light plant, to be built at the Virginia Military Institute, for which Edgar C. Wiley, National Bank Building, Lynchburg, Va., is preparing plans.

SEATTLE, WASH.—The Seattle Lighting Company is making preparations for the construction of a large power plant, which will cost about $750,000.

TACOMA, WASH.—It is stated that the Pacific Traction Company will soon apply to the City Council for a franchise for a scenic electric line along the bluffs, overlooking the water front, through Old Town to Defiance Park.

GOLDENDALE, WASH.—A franchise has been granted to the Washington Electric Railway & Power Company to construct, maintain and operate an electric railway and power line over certain highways in Klickitat County.

SEATTLE, WASH.—The property owners of Third Avenue have submitted a petition to the Council asking for the installation of a lighting system on that avenue. It is stated that the property owners will pay the cost, provided it does not exceed $18,000.

SPOKANE, WASH.—Connection has been made by the Washington Water Power Company with its new plant at Post Falls. Only one of the three generators, each capable of generating 3,000 hp, has been put in operation. Eventually six generators are to be installed in the plant, with a total development of 18,000 hp. Provision has been made for the installation of three more generators as soon as they are needed. With the plant completed and the available power in the Spokane plant, the company is now in a position to develop 50,000 hp at short notice. D. L. Huntington is general manager.

WHEELING, W. VA.—A new electric light plant is being installed in North Wheeling Hospital by the Weisgerber & Ebeling Machinery Company of this city. The plant consists of two 26-hp gas engines and two dynamos.

UNION GROVE, WIS.—The Union Grove Telephone Company has been re-organized and will reconstruct its entire system. W. J. Callender is manager.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has filed an amendment to its articles of incorporation, increasing its capital stock from $5,000,000 to $10,000,000. Alonzo Burt is president.

HATFIELD, WIS.—The La Crosse Water Power Company is contemplating the development of a water power at Hatfield. The work includes the construction of a dam at Hatfield and transmission lines to Winona, Minn., and La Crosse, Wis., a distance of 50 miles to each city, and the complete installation of a power plant. It is reported that the company has $3,000,000 available for the project. W. J. Ferris, of Champaign, Ill., is to be manager of the company.

PORTAGE, WIS.—Work will soon commence on the new dam below the Dells of the Wisconsin River, which is to be constructed by the Wisconsin River Power Company. The company will develop not less than 10,000 hp and has let contracts for four units of 2,500 hp each. The company expects to have its plant in operation by April, 1907. The Portage Electric Light Company has contracted for 2,500 hp and will control the output of the power company in this city. The I. W. York & Company flour mills and the Wisconsin Cement Company have made arrangements to obtain electricity from the plant when completed to operate their mills.

VANCOUVER, B. C.—The Council has approved the proposed Harris Street and Ninth Avenue extensions of the British Columbia Electric Railway Company and work will soon commence on the construction of the new lines.

WINNIPEG, MAN.—The Winnipeg Electric Street Railroad Company will build another loop through the western portion of the city. Wilford Phillips is general manager.

WINNIPEG, MAN.—The Selkirk Electric Light & Power Company has sold its plant to a new company, consisting of Mr. Flavella, of Lindsay, Ont., and several Winnipeg capitalists.

GODERICH, ONT.—The ratepayers have passed the by-law to guarantee bonds to the value of $150,000 for the Maitland River Power Company.

Company Elections.

PETALUMA, CAL.—At the annual meeting of the Two Rock Rural Telephone Company held recently the following officers were elected: T. G. King, president; E. P. Nisson, vice-president; G. W. Gaston, secretary.

PLYMOUTH, MASS.—At the annual meeting of the Plymouth Electric Light Company, held recently, the following officers were elected: James N. McCoy, president; Frank C. Calley, treasurer; directors, James N. McCoy, Fred P. Weeks, Warren G. Chase and Frank C. Calley.

FRANKLIN, MASS.—At the annual meeting of the Franklin Electric Light Company held recently, the following officers were elected: Joseph F. Bartlett, president; E. I. Cassidy, secretary; W. C. D. Thomas, treasurer. The above with C. W. Schuler, W. D. Russell, Porte Farwell and C. W. Hazelton form the board of directors.

WINONA, MINN.—At the annual meeting of the Winona Telephone Company, held recently, the following officers were elected: James A. Tawney, president; P. E. Baumgarter, vice-president; Otto Troost, Jr., secretary and treasurer.

New Industrial Companies.

THE ELECTRICAL INSTALLATION COMPANY, of Chicago, Ill., has filed amendments to its charter increasing its capital stock from $100,000 to $200,000.

THE INTERNATIONAL TELAUTOGRAPH COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $20,000 by John R. Turner, L. M. Logan and Charles P. Treat.

THE AMERICAN TELEMETRE COMPANY, of Augusta, Me., has filed articles of incorporation with a capital stock of $1,500,000. A. M. McComber is president and E. J. Pike, treasurer, both of Augusta.

THE INTERNATIONAL REDUCTION COMPANY, of Phillipsburg, N. J., has filed articles of incorporation with the Secretary of State, with a capital stock of $3,000,000. The incorporators are William L. White, Harry G. Selp, S. C. Smith and Noah Dietrich.

THE ELECTRICAL CONSTRUCTION COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $5,000 to manufacture and install electrical wires and apparatus. The incorporators are Ambrose Fleming, Kenneth Fraser, B. Carroll Shipman, Harry K. Brooks and Elmer J. Jones.

THE ALEXANDRIA ELECTRIC COMPANY, of Richmond, Va., has been chartered for the purpose of engaging in electrical work and the sale of electrical apparatus and supplies. The capital is fixed from $50,000 to $100,000. The officers are W. L. Mathues, of Media, Pa., president; J. E. Rigby, of Media, Pa., vice-president; E. E. Mandeville, of Philadelphia, Pa., secretary and treasurer.

New Incorporations.

MOBILE, ALA.—The Mobile Illuminating Company, of Mobile, has been chartered with a capital stock of $125,000 by George S. Emery, president; Henry W. Shields, treasurer, and others.

RUSSELLVILLE, ARK.—The Atkins Telephone Company has been incorporated with a capital stock of $10,000. The company has purchased the exchange at Russellville, formerly owned by the Russellville Telephone Company. G. T. Brown was elected president and Joseph Brown, manager.

REDDING, CAL.—The Shasta Southern Railroad Company has been incorporated by the owners of the Redding & Red Bluff Railroad Company to take over the business of the latter company. The purpose of the company is to build a road from Redding to Vallejo; from Vallejo the road will be extended to Oakland and San Francisco. The company expects to have six miles completed by August 15.

HONOLULU, HAWAII.—The Kauai Railway Company has been chartered for the purpose of building an electric railway from Kekaha Mill to Wahiawa. The incorporators are H. M. Von Holt, W. A. Kinney, A. W. Carter, E. A. Mott-Smith and Alfred T. Brock.

PLOVER, IA.—Articles of incorporation have been filed by the Plover Mutual Telephone Company. S. T. Grove is president.

HEYWORTH, ILL.—Articles of incorporation have been filed for the Heyworth Telephone Company, with a capital stock of $10,000, by H. F. Fitchborn and others.

CHICAGO, ILL.—The Philo Fairland Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of $2,500. The incorporators are George Lovingfors, Martin Kearns and C. V. Cottrell.

CHICAGO, ILL.—Articles of incorporation have been filed with the Secretary of State for the New York, Boston & Chicago Electric Railway Company, with a capital stock of $10,000, by W. H. Case, V. H. Officer and Edward B. Kelly.

WOODSTOCK, ILL.—The Woodstock Heating & Lighting Company has been incorporated with a capital of $35,000 and has been granted a franchise to furnish electric lighting in the city. Frank W. Joslyn, of Woodstock, is one of the incorporators.

CHAMPAIGN, ILL.—The Danville & Eastern Illinois Railway Company has been chartered with a capital stock of $5,000. The incorporators and first board of directors are George M. Mattis, Charles A. Wright, W. H. Burke, Charles A. Zilly, of Champaign, and J. E. Johnson, of Danville.

INDIANAPOLIS, IND.—The Lafayette & Chicago Electric Railway Company has filed articles of incorporation with the Secretary of State, with a capital stock of $25,000. The company proposes to build and operate an electric line from Lafayette and Chicago. The directors are George Winfield, W. A. Hennegar, James M. Leatherman and others.

LAFAYETTE, IND.—The Lafayette & Hoopeston Interurban Railway Company has been organized for the purposes of constructing a line between Lafayette and Hoopeston, a distance of 45 miles. The directors are Henry A. Miller, Isaac E. Switzer, David E. Harrington, Elmer Hawkins, Edwin Zies, John H. Banks, W. E. Smith and Lawrence Burns.

FRANKFORT, KY.—Articles of incorporation have been filed for the Grayson Light Company, with a capital stock of $5,000, by H. L. Woods, of Olive Hill; E. C. Maggard, of Morehead; Winfield Scott and J. W. Strother, of Grayson.

KALAMAZOO, MICH.—The City Light Company has been incorporated with a capital stock of $125,000.

KELLIS STORE, MISS.—The McRae Independent Telephone Company has been incorporated by W. M. McRae, J. H. Adcock, Samuel Bell, Z. M. Gathright and others.

SPEED, MO.—The Speed Telephone Company has filed articles of incorporation with a capital stock of $6,050 by A. H. Eichelberger and others.

LINCOLN, NEB.—The Farmers' Cooperative Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are C. W. Rhorbaugh, president, and others.

SYKESTON, N. D.—The Sykeston, New Home & Roosevelt Telephone Company has been formed with a capital stock of $10,000.

DEPOSIT, N. Y.—Articles of incorporation have been filed for the Deposit Telephone Company with a capital stock of $12,000. The incorporators are William J. Ganey, Elmira; S. C. Ormsbee and H. F. Stevens, Syracuse; B. E. Radeker, Deposit, and others.

ALBANY, N. Y.—The Cross Island Traction Company has been incorporated to operate 42 miles of road from Brookhaven to West Sayville, on Long Island. The capital is $500,000. Directors include Wm. I. Moyer, Leroy Baldwin and Paul T. Brady, of New York.

HOLLAND, OHIO.—The Holland Telephone Company has been incorporated with a capital stock of $1,800. The incorporators are H. W. Stork, John Luebbert and John Heitman.

CHESTERVILLE, OHIO.—The Amesville Home Telephone Company, with headquarters at Chesterville, has been incorporated by A. E. Swaine, W. E. Clark, H. S. Hopkins, Hiram Hart and C. P. Yocum.

RUGGLES, OHIO.—Articles of incorporation have been filed for the Ruggles Telephone Company, with a capital stock of $2,000, by F. D. Hamilton, H. H. Sutherland, B. J. Ferris, Irwin Carpenter and W. G. Singer.

ZANESVILLE, OHIO.—Articles of incorporation have been filed for the Zanesville & Muskingum Valley Traction Company. The incorporators are Dr. Hissey and Zanesville associates. A nominal capitalization of $10,000 is given.

Legal.

PLANT IS A FIXTURE.—In an opinion addressed to J. J. Lermen, secretary of the Yosemite Valley Commission, Attorney-General Webb of California has held that the electric light and power plant now in operation in the Yosemite is a fixture and passes to the United States Government with the Park itself. This is in accordance with a decision of the Supreme Court that an engine, boiler and machinery erected by a lessee upon leased premises and attached by bolts thereto are fixtures. There is much other property in the valley the title to which has been in dispute since the recession act was passed. The Attorney-General has decided that horses, wagons, carts, harness, tools, implements and office furnishings are not fixtures and remain the property of the State.

CHICAGO CORPORATION TAXES.—Final decrees have been entered by Judge Grosscup in the United States Circuit Court, Chicago, in the cases of the seven public corporations against the county and other taxing bodies, in which a temporary injunction recently was granted, stopping the collection of big sums in taxes under an assessment of 1901. The court finds in its final decision that the assessment was void because it was made under coercion of a mandamus, unjust and violating the fourteenth amendment to the constitution. The following table shows the assessment of 1901 and what the companies have paid under the decision:

	Assessment of 1901.	Payment under decision.
Gas Light & Coke Company.....	$9,217,067	$317,648
Edison Company	1,800,761	69,779
Telephone Company	775,266	21,859
City Railway Company	5,001,300	192,517
South Chicago City Railway.....	433,886	6,592
Union Traction Company.....	11,973,690	187,252
Consolidated Traction	3,531,487	8,817

The case will be appealed.

A CAGED TIGER.—The Supreme Court of Louisiana has sustained the verdict for the plaintiffs in the suit of Sumnons versus the Shreveport Gas, Electric Light & Power Company; the case being one where two boys were injured by current diverted into the telephone wires from the lighting company's circuit. The Court held: "Due care requires of those using wires or conductors of electricity so to place and maintain them with reference to similar conducting agencies that dangerous contact be not probable; and where wires maintained concurrently by different parties are so erected or strung that they are likely to touch, possibly with destructive consequences, either or both parties must make efforts to remedy such dangerous condition, and if an injury occurs through the neglect of such duty, both are liable." In the course of its decision the Court said: "The legal situation of electric light and power companies sending this potent fluid along their wires may be illustrated by comparing it to that of a showman conveying a caged tiger through the streets of a crowded city. The show man must not only make sure of the cage, and not himself open the door, but be vigilant in seeing that nobody else opens the door. He could hardly expect that he would be heard to plead that some negligent person had opened the door. Of course, the situation is incomparably more complicated in the case of an electric

light or power company with its system of wires pervading an entire city, and the appreciation of the facts in particular cases may be proportionately more difficult; but the principle is the same. Indeed, the prisoner of the company is more sleepless and subtle and in its stroke more quick and sure, whence the need of even greater vigilance in keeping it safe within its prison wire. Under this view of the matter the negligence of the electric light company continued down to the moment of the accident, and hence was its proximate cause."

Obituary.

MR. T. F. MORRIN.—Mr. Thomas F. Morrin died at his home, 48 Brinkerhoff Street, Jersey City, on July 31, of apoplexy. He was 58 years old. He was president of the Morrin Climax Boiler Company. Mr. Morrin was the inventor of the Climax boiler. When he removed to Jersey City he became chief engineer of the P. Lorillard Company, a place he held for more than twenty-five years. The Climax vertical boiler with its twisted and nested tubes has become widely known in the art, and was adopted by several electric light and power plants, especially after its exhibition at the Chicago World's Fair in 1893.

Personal.

MR. H. L. McCULLOUGH has resigned as superintendent of the city lighting plant of Muncie, Ind., the city having made a contract with the Muncie Electric Light Company for street lighting. For the present he will continue as city light inspector.

MR. JOHN VAUGHN.—Apropos of the thirtieth anniversary of the invention of the Bell telephone, *Scribner's Magazine* for September will publish an article on the invention from the pen of John Vaughn. It is to be "A Full Account of the Invention and Development of the Telephone."

MR. T. A. EDISON is the subject of an article and interview by Mr. James Creelman, in *Pearson's Magazine* for August. A good deal that is not particularly new is contained in it, but it is all interesting. Mr. Edison says that the greatest factor in American progress is the newspaper press.

MR. J. W. TATUM, of Durham, N. C., is the inventor of a new train telephone which is to be given a practical test. It is claimed that engineers will be enabled to talk to each other while their trains are running at full speed, that any engineer on any part of the road can be called from any station, and that in case two trains are within danger distance of each other a gong will sound in each cab.

MR. A. V. ARROWSMITH, formerly vice-president and general manager of the Arrowsmith Electric Company, Harrisburg, Pa., is no longer connected with that corporation, which continues in business as heretofore. Mr. J. S. Musser advises us that the stores in Harrisburg and Reading are both being carried on and are doing a considerable business. The company has a specialty in the "Equipoise" telephone holder.

MR. E. P. THOMPSON, the patent lawyer, of 156 Fifth Avenue, New York City, is now establishing also a full, regular office downtown at 39 Cortlandt Street. He will, of course, carry on as before the uptown office where he has been established so many years. Mr. Thompson has associated with him now some well-known experts and specialists as advisers in connection with the work of his patent business.

MR. M. F. WESTOVER, of the General Electric Company, has been elected secretary of the Adirondack Murray Memorial Association. The objects of the association will be the preservation of the homestead, at Guilford, Conn., where the Rev. Mr. Murray was born; the erection of a monument over his grave which is at the homestead; the republication of his works and assistance in the education of his four daughters.

MR. HENRY E. VINEING informs us that the statement is erroneous that he resigned as electrical engineer of the Fire Department. The office was abolished and its incumbent dismissed on the ground that there was not enough electrical apparatus to require such expert service. Mr. Vineing points out that the department is now buying $26,000 of new material, and ought to have a large amount of apparatus for extensions and to replace that which is out of date. He built the New Richmond department on Staten Island. Mr. Vineing is titularly at the head of the list for superintendent of telegraphs of the department, and as he holds office under Civil Service rules, is bringing suit for reinstatement in the office alleged to have been abolished.

PROF. M. MERRIMAN.—Mansfield Merriman, Professor of Civil Engineering in Lehigh University, has been granted leave of absence for one year. He will spend the greater part of the year in practice as a consulting engineer, and after Sept. 1 will be associated with Clarence W. Hudson, M. Am. Soc. C. E., at 45 Broadway, New York. Professor Merriman will make a specialty of investigations and reports on the hydraulics of water supply and water power in which he is widely known as an authority through his "Treatise on Hydraulics" and his frequent employment as an expert in hydraulic cases. He is a past-president of the American Society for Testing Materials and a member of three of its committees. As a member of the American Society of Civil Engineers he has made important contributions to its Proceedings, the last of which, published in the number for May, 1906, is an extended discussion of the proper design of reinforced concrete beams, so as to secure economy of cost.

MR. A. CARNEGIE is the subject of a paragraph in one of Mr. H. G. Wells' recent articles in *Harper's Weekly*, in the course of which he says: "And through the multitude of lesser, though still mighty, givers, comes that colossus of property. Andrew Carnegie, the jubilee plunger of beneficence, that rosy, gray-haired, nimble little figure, going to and fro between two continents, scattering library buildings as if he sowed wild oats, buildings that may or may not have some educational value, if presently they are reorganized and properly stocked with books. Anon he appals the thrifty burgesses of Dumferline with vast and uncongenial responsibilities of expenditure; anon he precipitates the library of the late Lord Acton upon our embarrassed Mr. Morley; anon he pauperizes the students of Scotland. He diffuses his monument throughout the English-speaking lands, amidst circumstances of the most flagrant publicity; the receptive learned, the philanthropic noble, bow in expectant swaths before him. He is the American fable come true; nothing seems too wild to believe of him, and he fills the European imagination with an altogether erroneous conception of the self-dissipating quality in American wealth."

Trade Publications.

THE OKONITE COMPANY has issued in broadsheet form specifications for 30 per cent rubber insulating compound, with a table of voltage test and one of megohms per mile at 60° F., one minute electrification.

DEAN TELEPHONES.—Bulletin No. 103 of the Dean Electric Company, Elyria, Ohio, is devoted entirely to portable desk telephones. The 32 engravings show numerous forms of this type, together with their details and a number of circuit connections.

ELECTRIC CONTRACTORS' SUPPLIES.—The Steel City Electric Company, Third Street and Penn Avenue, Pittsburg, Pa., has issued an illustrated catalogue of 24 pages, dealing with bushings, floor outlets, insulator supports, beam straps, reaming devices and conduit benders.

GOULD BATTERY LITERATURE.—The Gould Storage Battery Company has a complete corps of competent engineers in its employ, and it will be glad to take the problem as to whether a storage battery would be of advantage under the existing conditions and to give expert advice on the same. The company has now in press a new booklet on telephone batteries which it will be pleased to send without charge to those interested.

METROPOLITAN ENGINEERING COMPANY, 124 West 42d Street, New York City, has issued a handsome Bulletin in No. 7 for July, calling special attention to its signs, fans, Nernst lamps, etc., and illustrating some of its work at the Atlantic City N. E. L. A. convention. A report is also given upon the work done by the concern at the Meriden, Conn., Centennial, under the supervision of Superintendent C. A. Learned, of the Meriden Electric Light & Power Company.

ELECTRICITY IN THE HOME.—The Milwaukee Electric Railway & Light Company, at the time of the opening of its magnificent public service building in Milwaukee, issued a handsome souvenir booklet entitled "Electricity in the Home." It illustrates some of the features of the Public Service Building, and then drifts into the domestic applications of electricity, finally giving several electric chafing dish recipes. It is gotten up in splendid style, and it is likely to be kept by persons into whose hands it falls.

FÉRY RADIATION PYROMETER.—List No. 38 of the Cambridge Scientific Instrument Company, Ltd., Cambridge, England, is devoted to the Féry radiation pyrometer. The limit of this pyrometer is from the 500° C. (below a red heat) up to the very highest temperature known. It is stated that 7,800° C, the temperature of the sun, has been measured by this pyrometer. No electric battery or standard of luminosity is required, the pyrometer with a direct reading galvanometer being complete in itself and weighing altogether only 13 pounds.

LIGHTNING PROTECTION APPARATUS.—Circular No. 1132 of the Westinghouse Electric & Mfg. Company describes and illustrates a complete line of apparatus for lighting protection. The frontispiece is an excellent illustration of a lightning discharge from cloud to ground. Lightning arresters for high and low-tension circuits, with their various details and accessories, are well illustrated and described. A number of pages give instructive information concerning the selection and location of protective apparatus, the making of grounds, etc.

THE IMPERIAL ELECTRIC MOTOR.—The Imperial Electric Motor Company, Arcade Building, Philadelphia, has issued a catalogue with a very handsomely illuminated cover, describing the Imperial electric motor equipment for electric automobiles, both of the ordinary and the trolley type. The electric power is supplied to each of the four wheels of the vehicle by means of a motor located adjacent to the hub of each wheel, this application of power making every wheel a driving unit. A number of illustrations show automobile coaches and cars and trackless trolley coaches. The details of the trackless trolleys are also illustrated.

WESCO CATALOGUE.—Catalogue No. 100 of the Wesco Supply Company, St. Louis, Mo., is a quarto cloth-bound volume containing no less than 823 pages and several thousand illustrations. Notwithstanding its size, the catalogue only deals with general supplies, the Wesco Company issuing also an electric railway and mining catalogue, telephone and housegoods catalogue, fixture and glassware catalogue, and a number of bulletins. Owing to the vast amount of ground to cover, the catalogue is illustrative rather than descriptive, though when necessary brief descriptions of articles or suggestions relating to their use are given.

ROLLING MILL MOTORS.—Crocker-Wheeler Co., Ampere, N. J., has just issued Bulletin No. 66, on its new "W" motors for rolling mills. These motors are of unusually strong and massive build, and are made for 220-volt current, one speed only, series or compound. They are made for outputs of 25 hp, 50 hp, 75 hp and 100 hp. The strength of the parts correspond approximately to that of the parts of ordinary motors of about twice the rated capacity of these machines. The field frame is of steel, octagonal shaped, with four poles and is divided horizontally, the halves being held by four heavy bolts on the outside. The upper half can therefore be removed almost instantly. In the 25 and 50-hp sizes, this removes also all the brush rigging, which is connected to the top half of the frame. The connections are all made outside the shells of the machine so as to be plainly visible and easily handled. The machines are jig made, and therefore interchangeable, and parts can be obtained from stock. The frame is of the inclosed type with hand hold covers suitably placed on front and rear ends, for inspecting the interior. The pole shoes are built up of sheet steel laminations, and are bolted to the poles by bolts having square heads sunk in pockets in the face of the pole shoes, and with nuts on the outside of the field frame. Each foot is drilled for two heavy holding-down bolts which will retain the motor securely on its foundation. The foot is designed for great strength in order to withstand the heavy torque peculiar to this class of motors. After running for one hour at full load the motors do not show a rise in temperature of more than 75°. Asbestos is used lavishly in the windings.

News of the Trade.

MR. B. F. W. BRYANT, of Alexandria, Va., advises us of the formation there of the Bryant Electric Company, at 128 King Street, as electrical engineers and contractors.

STURTEVANT ECONOMIZERS, built with metal-to-metal joints in the staggered pipe system, by B. F. Sturtevant Co., Boston, Mass., are being installed by the Municipal Electric Plant, Burlington, Vt., and Consolidated Railway Co., New Haven, Conn.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William Street, New York, has recently placed on the market a line of meters under the trade name of the "Victor" combination meter. These instruments show on one dial a direct reading of volts, amperes, watts and horse-power.

NATIONAL-ACME OFFICES. — The National-Acme Manufacturing Company of Cleveland, O., has transferred its New England office, now located at 176 Federal Street, Boston, to 96 Liberty Street, New York. Mr. M. M. Brunner, the present manager, will continue in charge. The Southern branch office is in the Empire Building, Atlanta, and the Western office and warehouse, 56 West Washington Street, Chicago.

STURTEVANT GENERATING SETS, Sturtevant electrical generating sets, equipped with enclosed, forced-lubrication engines, are being installed by the Elyria Pumping Station, Elyria, Ohio; Tintern Manor Water Co., Long Branch, N. J.; Canadian Fairbanks Co., Ltd., Toronto, Ont.; Henry Steers, Inc., New York City. The Staten Island ferry boats, "Robert Garrett" and "Castleton" are to be equipped with Sturtevant marine generating sets.

LUNKENHEIMER PICNIC.—The Lunkenheimer Company, of Cincinnati, O., celebrated its annual outing with a picnic on July 28. The entertainment was given by the company to all its employees and their families at Woodsdale Island, on the C., H. & D. Railroad. At these affairs the Lunkenheimer Company furnished all the amusements, refreshments and transportation free. This time there were two bands of music in attendance, together with a fine troupe of professional entertainers, and there is no denying the fact that the guests had a royal good time. It took two trains of ten cars each to convey 2,000 people to the picnic grounds, and the day was pronounced a dazzling success by everyone of the party.

PLUNGER ELEVATORS.—The growing popularity of "plunger" elevators over the older types has given rise to a demand for special machines for boring the holes into which the plunger sinks. This is especially the case where plunger elevators are used in tall office buildings, and for this service the Star Drilling Machine Company, of Akron, O., is manufacturing a special machine known as No. 25 Elevator Machine. Although Star drilling machines have always had a great reputation for fast drilling, this machine, by virtue of special features in design, is demonstrating its superiority over the ordinary types of churn drills for this class of work. The Star Drilling Machine Company reports that 31 of these special outfits have recently been sold.

"BRILLIANT" LAMPS.—The Brilliant Electric Company, Cleveland, O., has opened a special department to take care of the demands for "Brilliant" gem and "Brilliant" tantalum lamps. It will be under the personal care of Mr. E. J. Kulas, general manager, and will be submanaged by Mr. E. V. Henecke, who expects to cover a large part of the country for the purpose of exploiting these lamps. An illuminating engineering department has also been established for the purpose of assisting their patrons in the design and execution of illumination schemes. The service is given entirely free and requests for suggestions are earnestly solicited. The demand for the "Brilliant" tantalum lamp has, indeed, been beyond all expectations, and hence this effort to meet the wants and views of the customers of the company in these important directions.

NEWFOUNDLAND CARIBOU.—The Maine Central Railroad is making an unique offer in the form of a personally conducted trip to Newfoundland for caribou hunting this Fall. $200 pays all the bills from the time of leaving Boston on October 17th until the return, arriving in Boston, November 7, and Mr. W. D. Hinds, Maine's leading taxidermist, and who has hunted in all parts of the United States and for several seasons in Newfoundland, and who will have charge of the party guarantees practically that each member of the party will secure a fine stag caribou head. Full particulars may be obtained by addressing Mr. Hinds at Haines Landing, Rangeley Lakes, Maine, or Mr. E. E. Boothby, General Passenger Agent of the Maine Central Railroad, Portland, Maine.

W. N. MATTHEWS & BRO.—The Stombaugh guy anchor patents were purchased by W. N. Matthews & Bro., of St. Louis, Mo., in 1899. At this time the "dead-man" was the only known means of anchoring poles to the ground. W. N. Matthews & Bro. began to advertise the Stombaugh in 1900. They sold almost a thousand of them that year. The business increased rapidly. Judicious advertising, coupled with the great merit and labor-saving features of the Stombaugh guy anchor, caused it. In 1904, they had a very large business, and doubled it in 1905. They report more sales during the first six months of 1906 than the whole of 1905. In 1905 and 1906 patents were granted on the several very important improvements embodied in the type B anchor. When asked to what they attributed their wonderful success in the sale of the Stombaugh guy anchor, Mr. C. L. Matthews said: "To our absolute confidence in the anchor, backed up by the severest engineering tests; our willingness to ship them anywhere by prepaid freight on trial; to good, truthful printed matter, and to advertising in the best trade journals." W. N. Matthews & Bro. are owners of the patents and manufacturers of the following specialties: The Hargis splicing joint or sleeve, for making quick and "get-at-able" joints in telephone and telegraph cable. The Callahan Cable Roller, for putting up heavy aerial telephone and telegraph cables in the quickest and safest manner at the smallest cost. The Kearney cable clamp for doing away with splices and saving waste on cable of from 3/0 up to 1,500,000 c.m. at corners and dead-ends; but not for telephone work; the "Hold Fast" lamp guard to protect incandescent lamps on drop circuits under any and all conditions.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 31, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

827,077.—ELECTRIC BELL; Edward J. Burke, Brooklyn, N. Y. App. filed Mar. 14, 1905. A spherical or tinkle bell is fixed upon the usual vibrating arm of the bell in place of having an ordinary bell and striker.

827,087.—HARMONIC SIGNALING FOR PARTY-LINES; William W. Dean, Elyria, O. App. filed Aug. 9, 1905.

827,090.—TROLLEY POLE HEAD; John M. Fleming, Ottawa, Canada. App. filed July 13, 1905. The trolley wheel is swiveled on a vertical axis within an enclosing cage. A spring arm is provided to keep the wheel in normal alignment.

827,120. ELECTRIC ALARM; William O. Rehn, Dunkirk, New York. App. filed Oct. 11, 1904. A bar of expansible metal is included between fixed abutments so as to bend by temperature variations and a pair of stops may be adjusted to give any desired high and low temperature alarms.

827,122. RAILWAY SIGNAL SYSTEM; William E. Schieble, Miamisburg, O. App. filed Mar. 24, 1905. The invention mainly relates to the mechanical features of a contact wheel which is stepped around by two co-operating detents. The detents absolutely lock the wheel after movement.

827,142. SWITCH AND SIGNAL APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Nov. 2, 1903. In order to avoid excessive temperature variations in the supply of carbonic acid gas for operating switch signals, the patentee locates his gas reservoir under ground. Also has an expansion chamber and valve system to give uniform pressures in the actuating cylinders.

827,143. RAILWAY TRAFFIC CONTROLLING SYSTEM; Clyde J. Coleman, Rockaway, N. J. App. filed Mar. 31, 1904. The gas for operating the signals is allowed to initially expand through a long tapering duct with ribbed walls. The surface friction generates heat which warms the gas and prevents it from freezing.

827,154. ELECTRIC SIGNALING DEVICE; Patrick Kennedy, New York, N. Y. App. filed Apr. 26, 1906. Relates to non-interfering fire alarm signals. Has an auxiliary magnet and a shunt thereabout which allows the current to flow through its coils only when the line is receptive of a signal to be sent by the instrument.

827,179. PROCESS OF ELECTROLYTICALLY DISSOLVING IRON-OXID SCALE; Charles J. Reed, Philadelphia, Pa. App. filed June 26, 1905.

827,180. PROCESS OF ELECTROLYTICALLY REMOVING SCALE AND PRODUCING IRON SULFATE; Charles J. Reed, Philadelphia, Pa. App. filed Jan. 2, 1906.

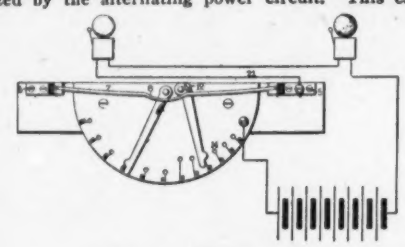
827,181. ELECTRIC SWITCH; George W. Richardson, Wissahickon, Pa. App. filed May 16, 1905. The switch arm is spring impelled in one direction and is held in thrown relation by toggle levers. When the levers are slightly displaced the switch blade abruptly returns to normal relation.

827,189. ELECTRIC RAILWAY; Bartholomew M. Stack and James F. Burns, Chicago, Ill. App. filed Sept. 1, 1905. Relates to that type having spaced contact plates along the roadbed. The contact plates are deeply inset in grooved insulating blocks and the conductors on the train are designed to be guided by these blocks.

827,218. ELECTRICALLY WOUND CLOCK; Arie De Vos, Des Moines, Ia. App. filed June 30, 1904. The clock is driven by a weighted arm which is intermittently raised by an electromagnet.

827,269. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Mar. 12, 1902. An alternating current magnet having field coils energized by the track circuit and closed circuit armature coils. The armature coils are unsymmetrically placed on the core and in case of an induced current therein by reason of an alternating field, they produce reactions which displace the armature so as to close the signal operating circuit.

827,270. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Mar. 12, 1902. Relates to modifications of the above in which the fields are energized from the track circuit and the armature is energized by the alternating power circuit. This causes a displacement of the armature for alternating currents in the field, but not for direct currents.



827,120.—Electric Alarm.

827,293. METHOD OF TREATING COTTON; George D. Burton, Boston, Mass. App. filed Nov. 20, 1905. In order to make cotton look like wool the patentee uses the electrolytic bath to which wool is subjected for scouring, for afterward washing the cotton.

827,297. ALKALINE BATTERY; Thomas A. Edison, Llewellyn Park, N. J. App. filed July 21, 1904.

827,310. SWIVELING CURRENT TAP AND LAMP SOCKET; Charles F. Howes, Cambridge, Mass. App. filed Mar. 29, 1905. Has a central swivel bolt which constitutes one connection and an annular ring which is peripherally engaged by a brush to make the other connection.

827,312. MAIL CARRIER; Frank S. Jolly, McFall, Mo. App. filed Feb. 5, 1906. An ordinary telpher having a trolley and gear shifting mechanism by which it is reversed.

827,314. CURRENT COLLECTOR; Arthur Linden and Paul Hiersemann, Vesteras, Sweden. App. filed Oct. 18, 1905. Has a contact bow and a rhomb guide of the electric locomotive type. The contact bow has an independent spring movement independent of the rhomb guide in both directions.

827,315. COIL FORMER; Julius W. Lundskog, Lynn, Mass. App. filed Dec. 29, 1903. A coil former for armatures. The former is in two parts hinged together and acting on the coil to properly bend the same by their relative movement.

827,319. ALTERNATING-CURRENT MOTOR; Maurice Milch, Schenectady, N. Y. App. filed Jan. 3, 1905.

827,320. MOTOR CONTROL; Jakob E. Noeggerath, Schenectady, N. Y. App. filed Nov. 17, 1905. In order to be able to run a number of alternating-current motors in series with one another, the patentee has a uni-polar generator connected in parallel with all the motors, and having armature taps to each motor of the series.

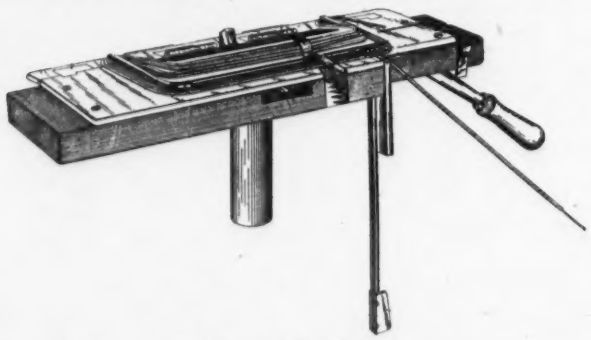
827,322. DISTANT CONTROL OF ELECTRIC MOTORS; Horace F. Parshall, London, England. App. filed Apr. 26, 1904.

827,323. ELECTRO-MECHANICAL SWITCH THROWER; James A. Posey, Midlothian, Tex. App. filed Sept. 14, 1905. Operates in the usual way by taking current or not at the car controller. The switch is thrown by the weight of the car depressing a tappet and the direction of throw is determined by a pair of locking levers selectively positioned by the controller manipulation as above stated.

827,325. NON-REVERSING TWO-WAY RUNNING TROLLEY POLE; Hilary Quertier, Dunedin, New Zealand. App. filed Oct. 9, 1905. The trolley pole projects vertically and a pair of spring impelled struts support the same in such relation both from a forward and rearward direction.

827,331. DYNAMO-ELECTRIC MACHINE; Leonard A. Tirrill, Lynn, Mass. App. filed Feb. 17, 1905.

827,344. TROLLEY RETRIEVER; Terry Blixt, Pittsburg, Pa. App. filed July 3, 1905. A retriever of the spring drum type with a pivoted lever forming a cord guide which is displaced by a sudden upward movement of the pole so as to release the re-winding spring. The cord is normally tensioned by a separate spring impelled drum.



827,315.—Coil Former.

827,353. CONTROLLING ELECTRIC SWITCHES; Charles E. Eveleth, Schenectady, N. Y. App. filed Oct. 3, 1903. An arrangement of circuits by which two overload transformers may be made to fulfill all the requirements of a three-phase system. For this purpose the transformers are de-phased with respect to the line.

827,360. COLLECTOR RING; Henry Geisenhoner, Schenectady, N. Y. App. filed Feb. 10, 1905. Has a flexible means for securing the collector ring to its support so as to permit a limited movement of the collector ring relative to the support in a direction parallel to the axis of the ring.

827,361. INSULATING SUPPORT FOR ELECTRICAL CONDUCTORS; William K. Gobboney, Buffalo, N. Y. App. filed July 28, 1905. A device by which ordinary insulators may be utilized for the support of high potential line wires. Has a suspension frame embodying three sets of insulators in series, and depending from the usual cross arm of the pole.

827,387. APPARATUS FOR MOUNTING AND COOLING STATICAL OZONIZERS; Marius Otto, Paris, France. App. filed July 1, 1904. Relates to features of a prior patent for ozoning air by parallel plates or electrodes. Utilizes liquid air as the working substance.

827,411. RAILWAY TRAFFIC CONTROLLING APPARATUS AND SYSTEM; Henry Bezer, Westfield, N. J. App. filed Jan. 23, 1905. Details of circuits for a signal system having danger and caution signals, direct current energized track rails, and polarized relays.

827,449. TELEPHONY; Isidor Kitsee, Philadelphia, Pa. App. filed Mar. 1, 1901.

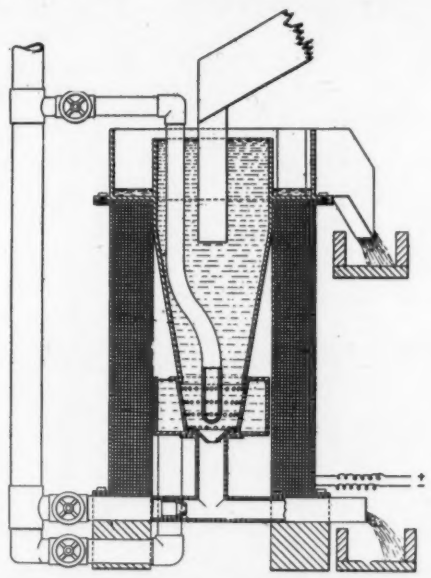
827,455. RESISTANCE DEVICE; Harry W. Leonard, Bronxville, N. Y. App. filed May 13, 1905. The resistance element is enameled and wound on a porcelain tube. The whole is enclosed in dry sand within a metallic casing.

827,469. AUTOMATIC MAGNETIC CIRCUIT BREAKER; William M. Scott, Philadelphia, Pa. App. filed Oct. 14, 1904. Has a winding producing a magnetizing force de-phased with respect to the impressed electro-motive force, and a winding producing magnetizing force having a different phase relation with respect to the impressed electromotive force and means for bringing said magnetizing forces more nearly into the same phase relation.

827,478. APPARATUS FOR ELECTROPLATING CYLINDRICAL ARTICLES; Robert C. Totten, Pittsburg, Pa. App. filed Jan. 31, 1905.

827,497. STATIC ELECTRIC MACHINE; Otto Baysdorfer, Omaha, Neb. App. filed Nov. 9, 1905. Details of construction of an induction machine having stationary and movable plates and specially constructed brushes and supports.

827,499. APPARATUS FOR MAGNETIC SEPARATION; Gustaf G. Bring, Petersfors, Sweden. App. filed Feb. 10, 1905. A receptacle is contained within the core of a solenoid and the liquid carrying the ore particles is made to flow through the receptacle. The magnetic particles issue at one orifice while the non-magnetic ones issue at a different point.



827,499.—Apparatus for Magnetic Separation.

827,523. WIRELESS TELEGRAPH SYSTEM; Lee DeForest, New York, N. Y. App. filed Dec. 6, 1905. Has a transmitting and receiving antenna at each station, the transmitting multiple antenna having a larger number of conductors more closely spaced together than the receiving antenna.

827,524. WIRELESS TELEGRAPH SYSTEM; Lee DeForest, New York, N. Y. App. filed Jan. 2, 1906. A modification of the same for use on shipboard having a single antenna and a responder associated therewith and magnetic means operated by the transmitting key for moving an element of said responder away from the other element thereof.

827,557. BLACKLEADING MACHINE; William H. Nicholas, Boston, Mass. App. filed Nov. 17, 1903. Relates to machines for applying powdered plumbago or black lead to wax molds prior to the electrotyping process. Covers details of the box and matrix supporting bed.

827,573. CLAMP AND SUPPORT FOR TELEGRAPH AND TELEPHONE CABLES; Howard E. Sheely, Michigan City, Ind. App. filed June 7, 1905. Two insulating blocks, grooved to receive a conductor between them, may be clamped to each other and to a supporting pole.

827,576. TELEPHONE ATTACHMENT; Homer E. Smith, Norwich, N. Y. App. filed Oct. 17, 1905.

827,625. TELEPHONE-TRANSMITTER; Charles C. Gilchrest, New York, N. Y. App. filed Mar. 25, 1905.

827,663. COMBINED CONTROLLER AND DIMMER SWITCH; James W. Pierce, Minneapolis, Minn. App. filed Dec. 5, 1904. A mechanism by which the stage electrician can make all the manipulations of the lights ordinarily required, by a single lever which can be clutched to work the controller or the dimmer rheostat as required.

827,681. ELECTRIC RAILROAD; George W. Browne, New York, N. Y. App. filed Feb. 23, 1905. A pair of depressible tappets are positioned on either side of the third rail and are acted on by the collector shoe to switch the third rail sections into and out of the power circuit.

827,683. SIGNAL APPARATUS; Clyde J. Coleman, New York, N. Y. App. filed May 7, 1902. This patent claims broadly the application of liquified gas at local points for the operation of railroad signals.

827,685. ELECTRIC SIGNALING APPARATUS; John W. Darrah, New York, N. Y. App. filed May 9, 1905. A watchman's reporting box having a generator driven by clock spring. The spring is normally wholly unwound, and is tensioned to transmit the signal by the manipulation of a hand lever.

827,692. DESK-TELEPHONE; Stephen C. Houghton, Rome, N. Y. App. filed Oct. 23, 1905.